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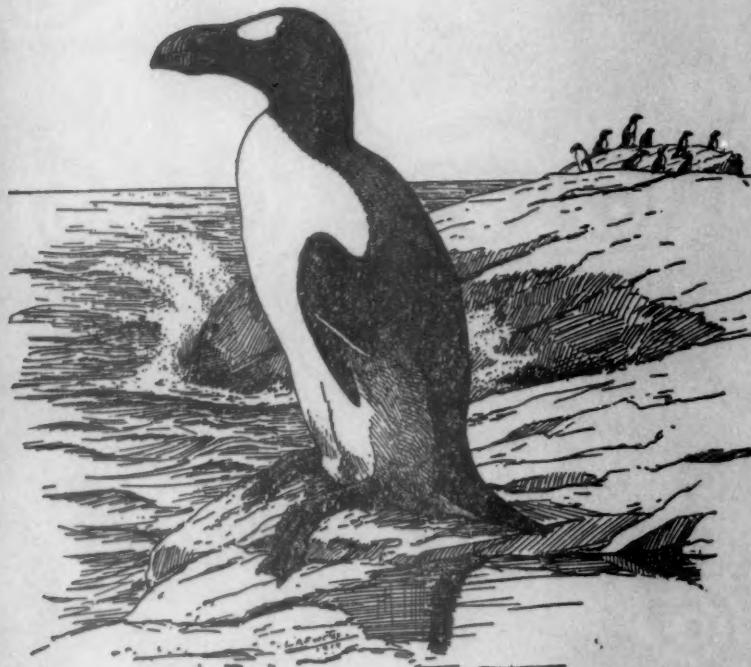
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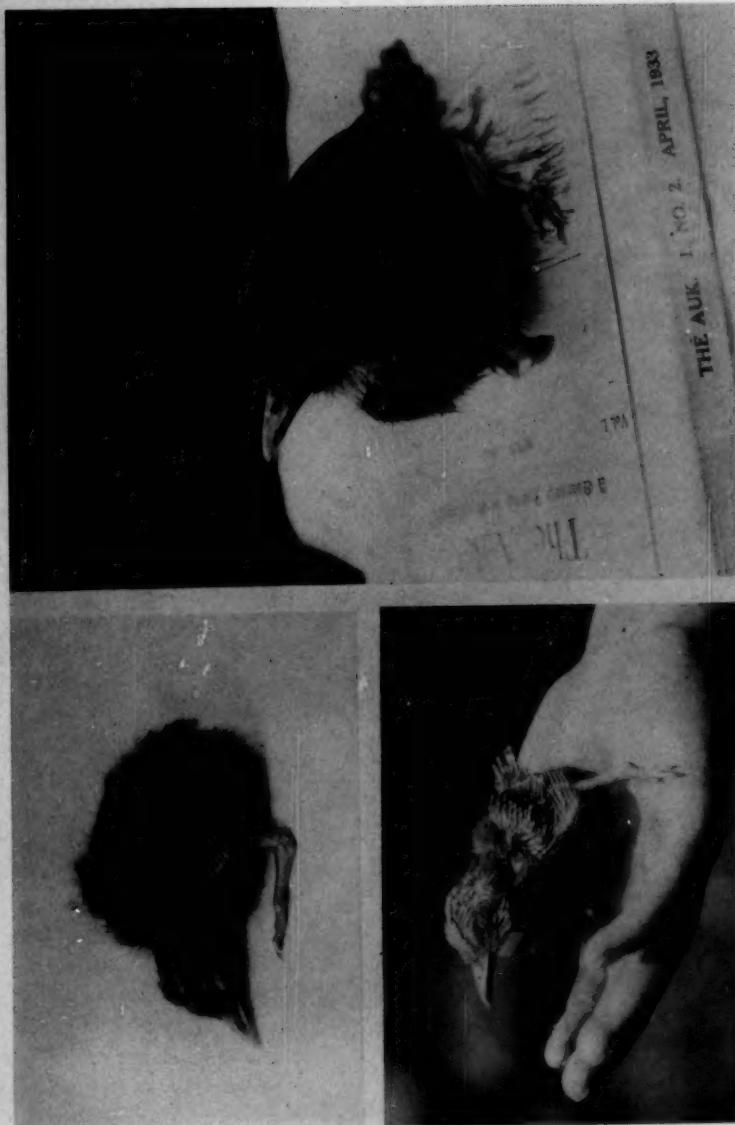
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(Upper left) BLUR-THROATED GREEN MOTMOT, 11 DAYS OLD. (Lower left) TURQUOISE-BROWED MOTMOT, 12 OR 13 DAYS OLD (NOTE FAR GREATER DEVELOPMENT OF DOWN ON THE SLIGHTLY YOUNGER BLUE-THROATED GREEN MOTMOT). (Right) FLEDGLING BLUR-THROATED GREEN MOTMOT, ABOUT FIVE WEEKS OLD.

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LIFE HISTORY OF THE BLUE-THROATED
GREEN MOTMOT

BY ALEXANDER F. SKUTCH

Plate 22

THE motmots are a small family of medium-sized, arboreal birds confined to tropical America. Their nearest relatives in this hemisphere are the kingfishers which they resemble, in external characters, most obviously in the form of the foot, which has the two outer toes joined for a good part of their length, and only a single toe directed backward—in sharp contrast to some of the other non-passerine arboreal birds of the tropical American forests, with two toes directed backward. In their mode of reproduction, motmots and kingfishers also show many resemblances. Motmots and trogons are, to my mind, the two most beautiful families of larger birds in the American Tropics; but their coloration is strikingly distinct. The plumage of the trogons is very brilliant, often with a metallic luster, while motmots are clad in softly blended pastel shades, chiefly of blue, green and chestnut. Their loveliness is enhanced by the peculiar grace of their tails. The rectrices are strongly graduated in length, and in most species the shaft of each feather of the long central pair is naked for an inch or two just before the tip, forming a slender stalk that supports an oval disk or racquet at the end. When these feathers first grow out, the vanes are intact along the entire length of the shaft, but often narrowest in the subterminal portion from which they will later be removed. The feather barbs appear also to be more loosely attached in this region, and break away as the bird preens its tail, leaving the shaft naked.¹ The Blue-throated Green Motmot (*Aspatha*

¹ There is a weakened structure of the barbs close to their juncture with the shaft which facilitates the separation.—ED.

gularis) differs from nearly all other members of the family in its entire central rectrices.

Some members of the motmot family, as the Great Rufous Motmot (*Baryphthengus martii*), dwell among the tree-tops in heavy lowland forest. But the exquisite Turquoise-browed Motmot (*Eumomota superciliosa*) prefers the tangled thickets that cover abandoned clearings in the humid districts, or the cacti and thorny scrub of arid regions, where it lives side by side with another species, the Chestnut-headed Motmot (*Momotus castaneiceps*), restricted to a semi-desert valley. The subject of the present study is again quite exceptional in the family in its high-mountain habitat. Motmots appear to be most abundant in northern Central America and southern Mexico. Here, especially in the more arid and open regions, they are among the abundant and conspicuous birds; one can not walk far through the thorny scrub and cacti of such districts as the middle Motagua Valley of Guatemala, or the Pacific side of the Isthmus of Tehuantepec, without becoming aware of them. On the other hand, during nearly a year in northwestern South America, in which I travelled widely on both sides of the Andes in Perú, Ecuador and Colombia—most of the time not primarily engaged in studying birds, but always alert to see them—I did not meet a single motmot.

Little has been published on the life history of motmots. Among the most extended notes on their breeding habits that have come to my attention are those published long ago by Robert Owen (1861, quoted by Salvin and Godman, 1879–1904), and by Gaumer (1881–1882), who presents certain theories I find it difficult to accept. The present study is one of a series projected some fifteen years ago to illustrate with life histories of representative species the habits of the principal families of neotropical birds. The publication of results has proceeded even more slowly than the gathering of information in the field. My observations on the Blue-throated Green Motmot were made on the Sierra de Tecpán, above the town of the same name in the Department of Chimaltenango, west-central Guatemala, from February to December, 1933. In another paper (Skutch, 1942) I have described briefly the climate and vegetation of this region. Here I need repeat only that the woods on the mountain slopes between 7000 and 9000 feet—the zone in which most of the nests of this motmot were found—are composed largely of oaks, pines, alder, arbutus, and other broad-leaved trees; while from 9000 feet to the summit of the range at 10,000 feet, where our bird nests in small numbers, the dominant tree is the cypress (*Cupressus benthamii*), which forms magnificent forests of gigantic trees in an almost pure stand. The

climate is marked by strong seasonal variations, with an often very wet rainy season extending from about mid-May to mid-October, and a rather severe dry season covering the remainder of the year. From early November until the beginning of April, heavy frosts form almost every clear, still night on the open fields above 7000 feet. To one who knows the lowland motmots, nothing could be more surprising than to find a member of the family residing the year around in a climate such as this.

The Blue-throated Green Motmot is endemic in the highland area of Guatemala and Chiapas, where it ranges from about 4000 to at least 9600 feet above sea-level. By no means rare, it is yet so elusive that despite rather extensive travels through the highlands of the former country, I saw it only on the Sierra de Tecpán, where I spent so much time studying the birds. Although a not quite typical member of the family, and at all times excessively shy, its strong attachment to its burrows made it possible to follow all stages in its life history more completely than I succeeded in doing with the generally more confiding Turquoise-browed Motmot, to which I devoted much attention in the lowlands. In the concluding section of this paper, this highland motmot is briefly compared with its lowland relations.

APPEARANCE

The bird-lover's first meeting with a new kind of bird is always a memorable occasion, and particularly so when the species is so distinct as this. Often it stamps the bird's essential character far more vividly upon the memory than many subsequent meetings, which serve only to modify the first impression. It is pleasant to recall my first encounter with the Blue-throated Green Motmot on the Sierra de Tecpán. The morning had dawned dark and cheerless, and the wind drove a chilling cloud-mist across the mountain from the west. I fled before the wind and clouds and started down a long, steep slope that faced the south, passing rapidly through a close stand of young oak trees, a coppice-growth from stumps left at an earlier cutting, among which stood an occasional pine, alder or arbutus. The ground was thickly covered with fallen oak leaves and pine needles, which rustled beneath my tread and made the descent excitingly slippery. I passed quickly downward, for there was little variety in the vegetation to attract my attention on the way; and near the foot of the long slope I came into a region where the stand of trees was more open, with flowering herbs and shrubs between them, and the sun shone from a blue sky. Here and there among the bushes,

the pretty flower-heads of the shrubby ageratum sent back an answering reflection of blue from the earth. On this leeward slope, wind and cloud-mist seemed very remote.

A green bird darted across a clear space and disappeared among the close-set branches of an oak tree. I stalked it; and after several successive retreats it remained stationary on a low branch, in full view. I was delighted with my find. The bird was of medium size, nine or ten inches long, entirely clad in a beautiful, soft shade of green, except for the pale buffy feathers that surrounded the eyes and covered most of the cheeks, the black ear-coverts, the azure throat, and the blue that terminated the two long central tail feathers, gradually blending into their green basal portions. It sat quietly on the branch, turning its big head toward me and calmly inspecting me with large, brown eyes. The deliberate way it twitched its tail from side to side, with an occasional abrupt jerk up and down, betrayed its affinity to the motmots; but the vanes of the long middle tail feathers were perfectly entire, without the racquet-like tips of all the members of this family I had previously seen. When the bird suddenly made a graceful about-face on its perch, lifting its tail over the branch with a flourish, I had no longer any doubt of its family relationship, in spite of the untrimmed tail feathers. The broad, heavy bill, hooked at the tip, with stiff bristles springing from the base, were added proof that my new bird was a motmot. After a few minutes it suddenly darted away, without having voiced a single note. I have used the neuter pronoun because I afterwards learned that the sexes of the Blue-throated Green Motmot are not distinguishable in the field, and I shall never know whether the first of the species that I ever beheld was a male or a female.

THE BURROWS—THEIR USE BEFORE THE BREEDING SEASON

This, my first encounter with the Blue-throated Green Motmot, took place during my first visit to the Sierra de Tecpán, in November, 1930. When I returned in February of the third year following, I found a number of burrows in the earthen roadside banks. The absence of cobwebs in the tunnels, and the freshness and sharpness of the two parallel grooves or ruts that ran along the bottom, left no doubt in my mind that they were in use and that they belonged to birds; but because of the earliness of the season, I doubted very much whether there were eggs or young within. As to the makers of these burrows, I felt certain that they must be the motmots. Aside from the Cobán Swallows (*Notiochelidon pileata*), whose burrows would be marked on the bottom with a multitude of fine scratches instead of

deep furrows, I had found on the mountain no other birds belonging to families which customarily nest underground. But my conjecture that the burrows belonged to the motmots needed confirmation.

Using the expedient of setting a little green twig upright in the entrance of a burrow, in such a manner that any bird passing in or out would be obliged to push it over, and then revisiting the burrow at intervals, I learned that it was entered only at the close of the day. The following evening I arrived before sunset to watch in front of this burrow, from a place of concealment among the bushes on the opposite side of the road. I waited an hour, but no bird came to enter the tunnel; the Whip-poor-wills began to call and the earliest fireflies to glow, and I was beginning to fear that my vigil had been made in vain. Just as I was about to abandon the fruitless watch, a form dimly seen flew out of the dusk and darted into the burrow, uttering a sort of laughing call as it went. I had not seen the vapory figure clearly enough to recognize to what species the bird belonged. It was already too dark to write in my notebook, and most diurnal birds had become silent for the night. Only the Rufous-collared Thrushes (*Turdus rufitorques*) continued their twilight carolling from their roosts among the pine trees.

The next morning, long before dawn, I went out into the mist and cold drizzle to make another attempt to clear up the mystery of the burrows, and took a post in front of the one that I had watched on the previous evening. Dawn had scarcely begun to augment the wan gray light that filtered through the thin clouds from the waning moon, when an obscure form darted out of the burrow, uttering the same queer note I had heard as it entered, and in an instant was lost in the fog. Although this note was sharper, it bore just sufficient resemblance to one of the calls of the familiar Lesson's Motmot (*Momotus lessonii*) to strengthen my suspicion that its author was a member of the same family. Before leaving the burrow, I set up a little twig in the entrance, and when I returned half an hour later I found that it had been pushed outward. There had evidently been a second bird in the burrow.

The following morning, as the earliest glow of dawn brightened the eastern sky, I took my stand just beside the entrance of a different burrow, and waited quietly. Before the brighter stars and the waning moon had lost their brilliance in the growing daylight, I heard low, musical murmurs emerge from the depths of the bank by my side. A minute later, a long-tailed bird flew out, passed in front of me and crossed the road, uttering a low, throaty note which again faintly resembled the call of an excited Lesson's Motmot. After another

minute a second bird flew out, but alighted in the road directly in front of the burrow. By taking a single step forward and bending over I might have touched it, or at least the spot where it stood. It was still too dark to distinguish its colors, but its graceful form stood sharply outlined against the gray roadway. It must have lingered in this motionless attitude a full minute before it darted away. A moment later the clear, mellow, almost soprano call of one of these birds sounded from among the oak trees.

By this time I had no reasonable doubt that the burrows in the roadside banks belonged to the green motmots; but I wanted to have a really satisfactory view of the birds as they came out in the morning, and make quite certain that I was right. It was of no use to stand beside the burrows in the dawn—the occupants always emerged before there was enough light to distinguish colors—so I decided to delay their departure until a time more convenient to myself. Toward the end of the night, I stopped the mouths of some of the burrows with handkerchiefs. I waited until it was quite light before removing the obstruction, then stepped to one side to watch the birds emerge. At first I managed to frighten them, and they would not abandon their deep retreat while I waited. But my failures taught me what precautions must be taken, and finally one morning, a few minutes after I had stealthily pulled the handkerchief from the entrance of a burrow, two Blue-throated Green Motmots darted forth and were clearly seen. These, then, were the tenants of the baffling burrows.

On my rambles over the mountain I had discovered more than a dozen burrows of the type of these, chiefly in the roadside banks among the forests of oak, alder and pine between 8000 and 9000 feet above sea-level; but a few were in the sides of wash-outs on steep slopes. I determined to make a census, and learn how many occupants each contained. After a few unsatisfactory trials, I abandoned the attempt to count the motmots as they entered for the night. They never retired into their dormitories until the light had grown very dim, and it was difficult to follow their swift movements. For a variety of reasons, it was not practicable to watch the majority of these burrows from a blind. Although I experienced difficulty in seeing the birds in the dusk, their keener eyes invariably picked me out from my partial concealment among the bushes. They flew back and forth, hesitating to enter in my presence, and sometimes fluttered before the entrance without going in, thereby completely confusing my count, because I could not see clearly just what they did. At times they became alarmed and flew away to pass the night elsewhere.

The best time to count the motmots was as they left their burrows

in the dawn. On many a frosty morning of February and March, I arose before the east began to brighten, dressed hurriedly and warmly, and walked briskly through the cold night air to keep a tryst at a distant burrow. At the earliest glow of dawn, I stationed myself in the roadway, a few feet to one side of the entrance, where the motmots could not see me until they were already outside of the burrow. I soon discovered that if I leaned against the bank, slight sounds or vibrations through the earth would warn the shy occupants that some animal was close at hand, and they hesitated to come forth.

Before the brightest stars had been quenched by the flood of day, while the Rufous-collared Thrushes and the Brown-backed Solitaires (*Myadestes obscurus*) welcomed the dawn from the dark woods, low, musical murmurs would emerge from within the bank at my side. Sometimes they would be repeated again and again; but usually, upon hearing them, I had not long to wait until a motmot, dim, shadowy and colorless in the uncertain light, darted from the burrow so close beside me that I could hear the rustle of its beating wings, crossed the road voicing low, rapidly repeated guttural notes, and vanished among the bushes on the opposite side. Sometimes a second unsubstantial being followed almost at once; sometimes it delayed a few minutes before joining the first in the thickets below the road. Then from amidst the dark foliage there would issue a deliciously mellow piping, full and round and clear, an undulatory call that carried far across the dim woods and frost-whitened meadows. At times the first to emerge raised its clear voice while the mate still delayed in the burrow, and the answer of the latter came as a liquid murmur from within the earth; but usually it waited for the mate, and the two sang in unison to greet the new-born day with a single fluid harmony. When the two motmots were so far apart that I could distinguish their individual voices, I noticed that the voice of one, probably the male, was deeper and fuller than that of his mate.

This dawn song, which is rarely repeated during the hours of full daylight, and then almost exclusively in the mating season, is so clear and melodious that the bird which utters it must be ranked with the tinamous as one of the most gifted vocalists among families which are not true song-birds. It is incomparably more musical than the call of any other motmot that I have heard. How different from the dull, wooden *cawaak cawaak* of the lovely Turquoise-browed Motmot, or the deep, lusterless *cwaa cwaa* of the Broad-billed Motmot (*Electron platyrhynchus*), or the frog-like *coot coot* of Lesson's Motmot; how different again from the whispered hoot with which the Great Rufous Motmot greets the day! In addition to the rapid, undulatory piping

just described, the Blue-throated Green Motmots sometimes deliver a series of single liquid notes, which follow rapidly with rising inflection—an utterance no less pleasing than the other.

POPULATION

The motmots' burrows were scattered along the roadside banks, always close to the woods, and usually well separated from each other by fifty yards or more of intervening roadway. The birds considered that a bank three feet high was sufficiently lofty for their home-site, provided that it was vertical. Rarely two occupied burrows were close together. At the top of a narrow wash-out on the slope of a deep ravine, covered with cypress forest, I found two burrows only seven feet apart; but this was exceptional. Of the thirteen burrows to which I made visits in the dawn during February and March, eleven were occupied by a pair each. One burrow, from which a single motmot had emerged, was found the next morning to be deserted, and remained so throughout the year. Three motmots slept together in one of the burrows in the wash-out, two in the other. At this season the burrows were rarely if ever entered during the day, as the little twigs that I set upright in the entrances always testified. The burrows were only dormitories in which the motmots sought shelter from the nocturnal chill of these high mountains. The motmots of the hot lands, so far as I have been able to discover, occupy their burrows only while they hatch their eggs and rear their offspring.

Among the oak forests below 9000 feet, it was easy to find the motmots' burrows, for the birds made no attempt to conceal their entrances in the bare earthen banks. Had I needed them, I believe that I could have located several dozen within a radius of a mile. It was indeed far easier to find the burrows than to see the motmots themselves while abroad in the woods; I rarely caught sight of them except when I stood beside their dormitories to watch them emerge at dawn. I was told of a collector of long experience who several years before my arrival had worked for a month on the same hacienda. Although the *pájaro verde* had been described to him and he was on the lookout for it, he did not see a single individual, and went away unconvinced of its presence in this region! Certainly the casual observer would have called the green motmot a rare bird; but I found seven pairs sleeping in the banks along a mile of winding mountain road, and am not sure whether a species present in such numbers should be designated as rare. Basing my estimate upon the number of nests of each species that I found, and making all allowance for the greater ease of discovering those of the motmots with their more limited choice of

sites, I believe that these birds were quite as abundant as the Mexican Trogons (*Trogon mexicanus*), which almost anyone would have called a common bird among the oak woods. Yet I saw a trogon a score of times for every occasion that I glimpsed a motmot. The trogon's bright red belly and foolish habit of taking flight with a noisy cackling whenever it thinks itself discovered, make it conspicuous; but the motmot's almost uniformly green plumage, and its habit of stealing discreetly and noiselessly away whenever it finds itself observed, make it extremely difficult to see.

Among the cypress forests near the summit of the mountain the motmots were far less abundant. Indeed, I never suspected their presence until I found a burrow, and I never chanced to see one of the birds except when I stood at the entrance of the burrow to watch its occupants emerge early in the morning. By searching the banks along many miles of logging roads, I found one more burrow. These burrows were at an altitude of about 9600 feet, and a single pair of motmots slept in each.

FORM AND CONTENTS OF THE BURROWS

As March advanced, I waited for the motmots to dig new burrows in which they would breed; but when they failed to do so, I thought it advisable to open the old ones, so that I could time the laying of the eggs. I had learned, by studies of kingfishers and motmots in the lowlands, that the safest method of opening a burrow is to dig from the surface a vertical shaft that will barely touch the back of the nest-chamber, into which an opening just large enough to admit the hand is made. With the burrows in the soft alluvial soils of the lowland valleys, this was not difficult of accomplishment. After measuring the length of the burrow by pushing in a pliant section of a vine, and noticing the direction of its curvature, I could usually judge with sufficient accuracy the point where I should begin to dig. But the tunnels of the green motmots were often so tortuous that I could not even guess where they ended. Some took one or even two sharp turns, which made it impossible to push in a vine and determine their length. One went straight into the bank for 22 inches, then made a turn of 90 degrees to the right, and continued in this direction for 18 inches more. Here it turned abruptly through somewhat more than 90 degrees to the left, then extended 24 inches more to the end. To locate the end, I found it necessary to uncover much of the tunnel at the first bend, whence, by feeling with a stick and groping with my hands into the more distant portions, I formed a rough idea of the position of the sleeping chamber. Here I dug a second shaft which

fortunately touched the side of the chamber. I bridged over the uncovered part of the tunnel with pieces of wood, then filled in the earth and covered over the excavation with leaves and litter. The aperture in the side of the sleeping chamber, through which I intended to look inside from time to time, was closed off with a stone, and the hole filled and concealed in the same manner.

These twists and turns in the tunnels were apparently made because the motmots encountered roots and stones which forced them to change the direction in which they dug. The end of another burrow, almost directly beneath a small oak tree, was even more troublesome to locate, and required several successive attempts on different days, including the sinking of two shafts, before I finally reached it. Later, while trying to reach a third nest, after the eggs had been laid, I erred in my calculations and dug directly into the top of the nest-chamber, where unfortunately I broke a perfectly fresh egg. It was necessary to roof this chamber with a plank of oak wood before I could refill the hole. The remarkable outcome of these excavations and remodellings of mine was that not a single one of the four burrows that I opened was deserted. This was undoubtedly because the owners had become very strongly attached to them through long months of use, and so were willing to overlook these alterations. In the lowlands, where kingfishers and motmots dig their burrows only a short while before they are ready to lay eggs in them, the birds will almost surely desert if the slightest alteration is made before incubation is well advanced. Yet none of the lowland members of these families that I have studied is quite so shy as the Blue-throated Green Motmot.

The four burrows ranged from 56 to 70 inches in total length, and were exceedingly diverse in shape. Each at its end widened into an oval chamber with a low vaulted roof in which the motmots slept and afterwards reared their young. The chambers ranged from 10 to 14 inches in length, from $7\frac{1}{2}$ to $8\frac{1}{2}$ inches in width, and were from 4 to 5 inches high in the center. No bedding of any sort had been brought in, but the floor of each chamber was covered with a great mass of fragments of the indigestible hard parts of insects, especially of beetles, mixed with the loose earth. These fragments had been regurgitated by the birds during the course of many nights, and indicated clearly what they had been eating. There were very few seeds, showing that berries formed an altogether subordinate part of their diet. The volume of regurgitated shards and exoskeletons revealed that the burrows had been in use for a long period, for below the loose debris they had become consolidated to form a hard floor of considerable depth. Aside from these, the dormitories were perfectly clean, with no traces of excrement and very little odor.

THE EGGS—INCUBATION

I had now prepared four burrows into which I could peep whenever I desired. After each visit to the chamber, I was careful to close with wood or stone the aperture I had made, then to fill in and tamp the earth above it, and finally to conceal the whole with leaves and litter. Largely as a result of these precautions, I did not lose a single egg or nestling (except the one egg broken while preparing the burrow for study).

All four of the female motmots laid their three pure white eggs at very nearly the same time, during the first ten days of April, just after the last of the nocturnal frosts at this altitude. They were deposited on alternate days—that is, at intervals of approximately forty-eight hours. The appearance of eggs in the burrow did not change the sleeping habits of the tenants, which continued to enter in the late dusk and pass the night in their customary chambers. Whether the eggs were actually incubated during the night before the set was completed, I had no means of telling, but during the day I frequently found them warm, and sometimes, even in the late afternoon, a motmot flew out when I opened the chamber to look in.

One afternoon both motmots flew out of a burrow, but only after I had been digging many minutes above their heads. When finally I uncovered the opening I had made in the side of the chamber, I could feel two warm eggs within. The following afternoon there were still only two eggs; and the bird that attended them bravely remained and allowed me to touch it (because I do not know the sex), with my finger tips. I felt a great desire to lift it out in order to make a better acquaintance with one of these retiring birds, but prudence suggested that I desist. A better opportunity would come later. This motmot was unusually brave; all of the others left their eggs before I could uncover the side-entrance to the chamber.

The measurements of the eleven eggs in the four burrows average 28.8×22.8 millimeters. The eggs showing the four extremes measured 30.6×22.6 , 28.6×23.8 , 27.8×22.6 , and 28.2×21.8 millimeters. In form the eggs were almost equally blunt at the two ends, and scarcely ovate. The pure white shells had little or no gloss.

During the entire period of incubation, both sexes continued to sleep in the burrow at night; but even if the sexes had been distinguishable, I still should have been unable to tell which was actually responsible for keeping the eggs warm. They continued their old habit of emerging at the first light, about half-past five at this season of the year. Now I failed to hear the soft murmurings which had

preluded their departure during the colder months; they were either silent or uttered only one or two low notes. The exits of the two birds were sometimes separated by only a minute or so, sometimes by as much as ten minutes. After emerging, they continued to sing in their soft, melodious voices, but no more than, and often not so much as, on the frosty mornings of February and March. Although not more inclined to sing, they called much more, especially before sunrise, when each of the pair sounded its flute-like monosyllable over and over at intervals of a few seconds, as they answered each other from various parts of the woods. While they breakfasted, the eggs were left unincubated; but the walls of their sleeping chamber, fairly dry at this season, had been well warmed by the animal heat of the two birds during the night, and the eggs in their snug niche remained moderately warm for half an hour or more. I took advantage of this period, when both parents were away, to open the burrow and see whether the eggs were hatching.

This much I was able to learn merely by standing beside the burrows in the dawn, as I had done for the past two months; but to discover how the motmots arranged their time on the eggs during the remainder of the day, it was necessary to use the tent, and to set signals in the form of soft green twigs in the entrance of the burrow. Even with these aids the task was not easy, for the motmots were so shy that the presence of the brown cloth wigwam, twenty-five or thirty feet from the burrows, would keep them away, and it was necessary to conceal the blind itself, at least partially, among the raijón bushes. By spending the better part of three days sitting motionless in my tent, and by using green-twigs signals at other burrows as subsidiary evidence, this is what I learned:

After both birds flew from the burrow at dawn, the eggs were left unattended for three-quarters of an hour to an hour, a situation rather unusual among species of which both sexes aid in incubation. Then, at 6:15 or 6:30, one of the pair (which, to my regret, I can merely designate as A, since I do not know the sex), re-entered the burrow. Here it remained warming the eggs until about 10:00 or 10:30, roughly four hours. Then the other (B) returned, relieved A, and sat for about four hours longer—until, between two and three o'clock in the afternoon, A returned for another spell of sitting. At about six in the evening, the latter suddenly darted from the burrow, leaving the eggs again unattended while it went for supper. In about half an hour, one of the pair (now impossible to tell whether A or B), re-entered the nest, and when the evening twilight had become very dim, the mate rejoined it for the night.

These were the approximate times I found at one nest; but there was considerable variation in the hours of relief among different pairs, although I believe that the general scheme of dividing the day between the two was the same for all. On the first day that I watched before a burrow from a blind, when I did not know that the presence of the brown wigwam would be so objectionable to the birds, one motmot remained on the eggs, faithfully awaiting the long-delayed relief, for more than seven hours and probably a full nine—that is, from some time before nine o'clock in the morning (when I began to watch) until after four in the afternoon (when I removed the offending blind). This, however, was a session exceptionally long, caused by exceptional circumstances. On another day, this same motmot sat for six hours, as I learned by setting up a twig in the entrance, without disturbing the relief by my presence. Sometimes, especially when incubation had just begun, I found the eggs cold as early as half-past four or five o'clock in the afternoon, indicating that the bird which had been in charge of the nest had gone early for supper.

At times, the bird arriving to relieve its mate flew directly into the burrow, without giving any warning save the whirr of approaching wings, and the other partner, that had been sitting, darted out a minute later. At other times, the relief, upon arriving, perched near the burrow and called forth the mate with the peculiar low sound I had been accustomed to hear earlier in the season, as the motmots prepared to enter their burrows in the evening twilight. The call was so low that it was barely audible to me as I sat in the tent, but it did not fail to make its impression on the keen ears of the mate in the burrow, which came out at once and made way for the new arrival.

In the lowlands, I had many times tried to determine how many days the eggs of kingfishers and motmots required to hatch; but because of the readiness with which these birds abandon their burrows if they are tampered with before incubation has begun, I usually failed, with a single exception. The exception occurred when an Amazon Kingfisher (*Chloroceryle amazona*) did the unusual thing of laying a fresh set of eggs in an old burrow, from which the newly hatched nestlings of the first brood had mysteriously vanished. Since I had opened the burrow before the first set of eggs hatched, I was able to record the dates on which the eggs of the new set were laid, and to learn that they hatched after 22 days of incubation. In view of the close relationship between kingfishers and motmots, it was interesting to find that the Blue-throated Green Motmots' eggs in my four burrows hatched in 21 or 22 days after the last in each set had been laid. Strangely enough, in two of the burrows all of the eggs hatched within

24 hours; while in each of the other burrows the first two nestlings were born on the same day, the third on the following day. Yet in each nest the first egg had been laid five days before the last, and during the interval the parent birds not only passed every night in the burrow but were sometimes found within during the day as well. This leads me to believe that during the period of laying they did not actually incubate the eggs by night, but rather slept to one side of them.

THE NESTLINGS

The little motmots hammered for three or four days at the hard, white shells which held them in thrall, before at last they had made a gap which extended most of the way around the egg, and they were able to push off the large end and squirm forth upon the hard earthen floor of their dark nursery. The new-born birdlings were pink-skinned and absolutely featherless. Their eyes were represented only by two prominent black lumps on the sides of the head. Decidedly they were not beautiful creatures; but before they were a day old, they could already stand erect upon the full feet, with the swollen belly as the third point of the tripod, and even walk a trifle in a halting and tottering fashion. The empty shells from which they had escaped were promptly removed by their parents.

On the day when the nestlings hatched, the devotion of their parents was at its highest, most ardent point, and they remained covering their infants through all the noise of opening the burrows. I reached into the dark chamber and took hold of the guardian bird—mother or father, I could not tell which—which struggled ever so gently to escape. Slowly and carefully I drew it forth to the light, and beheld a creature whose feathers were as fair to the eye as I had already found them soft to the touch—and I have never placed hands upon a bird with softer, finer, looser plumage than these motmots. It looked silently and resignedly up at me with large, deep brown eyes, as soft in cast as the plumage was soft in texture. When I held it on its back for a few seconds, it seemed to fall into a waking sleep, and lay perfectly passive in my hand, as many other kinds of birds do under the same conditions. After I had replaced the nestlings, I lowered the parent carefully over them; and there it remained quietly while I closed over the hole, tamped down the earth upon it, and went away.

From only one of my four burrows did the parent motmot flee away while I was opening the chamber on the day the eggs hatched. But after the nestlings were two days old, the parents invariably retreated into an inaccessible portion of the tunnel, or else darted out and away before I could uncover the aperture in the side of the cham-

ber and reach in. Only once during the period of incubation had I been permitted to touch a bird on the nest.

It is characteristic of young kingfishers and motmots that their feather-sheaths or 'pin-feathers' grow very long and conspicuous before the horny sheaths begin to ravel off and release the enclosed feathers. But the course of events with the young green motmots was quite different. At the age of ten days, when Turquoise-browed Motmots are beginning to bristle with the long, horny pins and bear no trace of down feathers, the blue-throats were nearly covered with very long, soft, ample down. Their backs were almost concealed beneath an abundance of dark gray down, while the down on the sides and flanks was more or less tawny. Upon examining the nestlings closely, it was easy to see that these down feathers sprang from certain very limited regions of the body; but the long, soft filaments billowed over and concealed the bare skin of the extensive featherless regions, and at this early age the little birds appeared decently and warmly clad. I can hardly doubt that this difference between the mode of feathering of the Blue-throated Green Motmots and their turquoise-browed relations has resulted from the different needs of each. The former, resident in the cold highlands, require early protection so that their parents may cease to brood them by day and devote more time to finding their food; the latter, in their burrows in the warm lowland soil, stand in no great immediate need of feathers. The earlier appearance of down feathers on the Blue-throated Green Motmots is not an indication of a generally more rapid development; on the contrary, they mature more slowly than the Turquoise-browed Motmots, and remain in the burrow several days longer.

Aside from their relatively rapid feathering, these young motmots developed slowly, as is the way in their family. They were twelve days old before their eyelids began to separate. Considering that sight must be of little use to them in their dark burrows, and that moreover they would run the risk of getting particles of their earthen ceiling into their eyes, this lengthened period of sightlessness is a wise provision of Nature. The flight feathers did not begin to cast off their long sheaths until the nestlings were sixteen days old. At this age they could hardly perch, but walked clumsily about, supporting themselves upon the whole foot, the heel of which was protected by a prominent, thick callosity, which was entirely smooth like that of jacamars, rather than roughened with small tubercles as with kingfishers, toucans, trogons and woodpeckers. Whenever I opened the burrow to take a look at the little birds, they were at first silent; but if I waited quietly for a minute or so, they began to call and to utter a sort of trill in a pleasant, soft voice.

Both parents joined in bringing food to the nestlings, whose fare consisted chiefly of big caterpillars of hairless sorts and other insect larvae, with an admixture of winged insects. On the morning when the three nestlings in Burrow 2 were fifteen days old, I spent four hours watching from the tent and saw the parents take food in to them nineteen times during this period. The old birds were exceedingly cautious in their approach to the nest and alighted low in the raijón bushes across the road, whence they carefully surveyed their surroundings from comparative concealment. While they waited there, peering cautiously around, I enjoyed a better opportunity to study their appearance than ever before—for one does not see a bird in true perspective while it is held in the hand. Despite their soft green plumage and clear blue throat, they seemed to me just to escape being beautiful. The pallid tawny feathers on their faces gave them a wan and even slightly sickly appearance which prevented their being completely satisfying to my eye. Assured that the coast was clear, they darted rapidly across the road into the mouth of the burrow, silently or uttering a queer little throaty noise. The food delivered, they shot forth head first from the burrow, one to five minutes later.

In common with other motmots and the generality of birds that nest underground, the parents never made any demonstration or feint of attack when I took their nestlings from the burrow, and never tried to lure me away as birds which nest on the surface of the ground so often do. Rather they remained at a safe distance while I was near the nest, and were either silent or made their little throaty noise.

By night, both parents continued to sleep in the burrow with their children, even after the latter had become well clothed with feathers and seemed too big to be brooded. A habit of such long duration is not easily broken. Both emerged at the break of day, as they always did. During the nestlings' final ten days in the burrow, however, some of the adults began to make different arrangements. In one instance the parents, which had only two nestlings, both continued to sleep with them so long as they remained underground. But at another burrow, only a single parent stayed with the youngsters during their last few nights in their nursery. A third pair arranged matters in still a different manner. First one, then the second parent gave up the habit of sleeping in the burrow; and during the last four nights before they took flight, the nestlings were alone. Those parents which elected to sleep in the open must have found the change from their snug underground quarters most uncomfortable, for by this time the rains had set in and nights were cold and wet. But the grown motmots that continued to sleep in their nests also had their troubles.

In the morning before they flew out, the nestlings made a terrible din, importuning to be fed with many loud trillings and mellow-voiced calls, which would have been pleasant enough to hear if they had not all been uttered at once, without any attempt at unison, in so confined a space. After continuing for many minutes, this clamorous chorus would end abruptly when the besieged parents retreated into the open. They lost no time in bringing breakfast to their hungry offspring, and sometimes returned with an insect in their bill before the light was strong enough to reveal their colors.

Meanwhile the nestlings which, when we last glimpsed them, were little clumsy balls of gray down, scarcely able to see or to perch, have been slowly acquiring their plumage and their strength. It was interesting to watch their transformation from gray to green. A bird may change its color by several methods. The most usual is by means of a molt, when the old feathers are bodily shed, a few at a time, and replaced by entirely new ones of a different color. Another mode of transformation which is not uncommon is known as 'plumage wear'; the dull tips that terminate the newly sprouted feathers gradually drop off, revealing far brighter hues that were overlaid and concealed by them. But the young motmots followed neither of these schemes. They could ill afford to shed their warm gray down—they needed every bit of it to get through the ordeal that lay just ahead—so they retained it all, but covered it over and concealed it by green feathers of subsequent growth.

While the development of certain feather rudiments was hastened to give the naked little birds a protective covering of fluffy down, other feathers continued to grow more slowly. This was particularly true of those along the very center of the back, which showed only their green tips at a time when the outer feathers of the same tract had become fluffy tufts of down. But these green feathers continued slowly to grow out from their sheaths and, spreading sideways, pushed down and concealed their loose gray neighbors which a short while before had been so prominent. Spreading still more broadly, the green feathers of the central row finally overlaid the gray down on the shoulders. Meanwhile the wings, which were gradually clothing themselves in green, began to conceal the loose gray and tawny feathers of the sides and flanks. Blue feathers appeared on the throat, tawny ones of the cheeks, and black ones over the ears. When this process of overlaying and concealing the infantine down was completed, the young motmots, now about four weeks old, quite closely resembled their parents except for their shorter wings and tails. They had gained a coat of green, and lost nothing. They had lost

even less than young passerine birds must lose, for the natal down of the latter, which is pushed out on the tips of the body feathers, must drop off before the fledglings appear grown-up.

A color transformation closely resembling that of the motmots is found in the nestlings of the Quetzal (Skutch, 1944).

DEPARTURE OF THE FLEDGLINGS

The young motmots remained long in their burrows, for they were nearly four weeks old before their slowly developing wing plumes would support them in the air. They finally departed from the nest from 29 to 31 days of age. This long period of helplessness surprised me, since the young Turquoise-browed Motmots left their natal burrows in the lowlands at the age of 26 to 28 days, yet they are about the same size. Both sets of nestlings had been removed for occasional examinations and photography. Perhaps the less favorable climate of the high mountains was responsible for the slightly slower development of the Blue-throated Green Motmots.

On the morning of June 3, I arose early, for I had a number of visits to make before daybreak. I climbed down a bushy slope to see whether a Pink-headed Warbler slept with her nestlings, then entered the heavy forest to peep into the nest of a Kaup's Redstart, and finally ended my journey beside a motmots' burrow in the roadside bank a mile from the house. As the cloud-mist that shrouded the mountain turned from black to gray, soft, musical murmurings issued from the earth. Soon one of the parent motmots flew out, and in five minutes was followed by its mate. In the pine trees across the road the pair sang briefly, in spite of the unpromising dawn. The sounds from within the burrow continued after their departure, for the last of the nestlings had not yet left home. Its calls soon became louder and quite different in quality from any that I had heard from a young motmot which had not yet flown. They continued intermittently for many minutes, sounding as though they came from a point near the entrance, and then the fledgling launched forth on its initial flight. Its course was somewhat wavering, but it knew instinctively how to make good use of its hitherto untried wings and rose steadily, mounting to a high branch of a pine tree growing on the slope below the road. As it departed from the burrow, one of the parents greeted it with loud, excited calls. Its graduation from the nest marked also a turning point in my own activities, for it was the last to leave the burrow of the eleven young motmots over whose infancy and childhood I had watched.

DIGGING THE NEW BURROWS

Now I confidently looked forward to seeing the whole family, parents and young, reunited in their burrow in the evening, because the wet season was firmly established and a cold rain fell almost every night. But it is never quite safe to hazard a prediction of the behavior of men or of birds. At the close of the following night, I again stood beside this burrow, and as the day broke a single motmot silently flew out, in place of the four—adults and young—I had expected would emerge. Two mornings later, both of the parents flew out of this burrow in the gray dawn; and they continued to occupy it nightly until the end of the year. Meanwhile, their children were left to weather out the rainy and misty nights among the foliage.

Other pairs arranged things differently. The parents who had left their nestlings entirely alone during their last nights in the burrow never returned to it, but elected to share their offspring's fortune in the open. Then there was the burrow in which a single parent had kept the nestlings company during their final nights there. After the young birds' departure, the other parent resumed sleeping there, and the united pair continued to occupy it until the new burrow was completed. Another pair of motmots, which also continued to sleep in the burrow after the fledglings left, abandoned it when, a few days later, a pair of Cobán Swallows claimed it and began to carry in leaves and pine needles for their nest.

Like kingfishers and jacamars, the motmots made no provision for the sanitation of their burrows, which were considerably befouled during the long tenancy of the nestlings. Those which continued to sleep in the old burrows after the young birds departed merely awaited a favorable opportunity to dig new ones for themselves. At first, they were too busy satisfying the hunger of their fledglings to engage in this difficult task, and the weather was so continuously wet that the excavation of a burrow would have been a most unpleasant undertaking. But during the last week in June there was a temporary lull in the rains, and the motmots quite generally took advantage of it to dig their new burrows. The soil was now in good condition for working, neither so wet as to be muddy nor so dry as to be powdery, as toward the end of the long dry season when they began to nest. Most of the young birds had now been a-wing nearly a month, and were doubtless able to find at least a good share of their food for themselves, relieving the parents of this burden and freeing their time for the new undertaking. No young motmot appeared upon the scene while I watched a pair, parents of three, dig their burrow. Yet the excavations

tion of new sleeping quarters seemed to be a seasonal phenomenon, not directly controlled by the circumstance that the young could now feed themselves. I recall one particular pair whose offspring were still in the nest more than two weeks after the majority of the nestlings had flown from their burrows. Yet this pair dug their new home at the same time as all their neighbors.

The site chosen for the new burrow was usually in the same bank, close by the old. One pair began their new tunnel only 20 inches distant from the one they had occupied during the previous year; another pair chose to go 28 feet away to dig their new home. These were the extreme distances among the five pairs I kept under observation at this period. One other pair, to which we have already had occasion to refer, continued to occupy the old burrow, in which two nestlings had been reared, at least until the end of the year. The chamber at the end of this burrow was the one to which I had been obliged to give a wooden ceiling, which at least could not have been distasteful to the occupants.

At the beginning of July, I spent many hours in the tent, watching a pair of motmots at work. Their plumage was worn and faded; apparently they had not yet molted and renovated the feathers worn by their arduous labors of the past three months. They had two periods of work daily, one in the morning, from about seven o'clock to nine or ten; the other in the afternoon, between three and six. So far as my observations went, they worked longer and more steadily in the afternoon. Male and female divided the task, laboring in alternate shifts of three to twelve minutes. They always came to the burrow together, and one remained perching not far off while the mate dug inside. As with jacamars, puff-birds, kingfishers, trogons and other motmots, I do not believe that either of the pair would have entered the excavation to work unless the other were close by. On entering the tunnel, the bird kicked vigorously backward, throwing out two parallel, intermittent jets of loose earth. These jets moved inward as the bird passed onward, until they fell short of the entrance and at last disappeared in the darkness of the burrow. Without much doubt, the diggers continued to kick backward until they reached the end of the shaft, and thus on each inward trip the earth loosened by the bill at the head of excavation on previous visits was gradually moved outward. On leaving, the motmots never pushed or kicked the loose earth before them. I have never seen jacamar, kingfisher, or motmot come to the mouth of the burrow it was digging for the purpose of ejecting loosened material, as woodpeckers do when carving out their holes in trees.

While one of the pair of motmots worked inside, the mate, resting in the bushes close by, repeated almost incessantly a single low, soft monosyllable, and at intervals flagged its tail slowly from side to side. Usually the partner which had been waiting entered the burrow quite promptly after its mate emerged, most often alighting in the road before rising to the mouth of the tunnel. Rarely it became impatient and entered while the mate was still inside, but then one or the other always came out very promptly.

BEHAVIOR DURING THE SECOND HALF OF THE YEAR

Once completed, the new burrows were promptly occupied. No eggs were laid in them that year, for the motmots raised a single brood; they were used as sleeping quarters only, and all were still occupied when my sojourn on the mountain came to an end the following January. The events in the motmots' lives from now onward were not so exciting as those I had witnessed during the breeding season; but I continued to make occasional visits to each burrow in the dawn, and so, in the dim light of the fog-drenched mornings of the wet season, or the frosty dawns of November and December, I received vague intimations of the vicissitudes in the lives of their tenants. During the latter half of the year, they were far more silent than they had been in February and March. Now, standing beside the burrow in the dawn, I seldom heard the low, confidential murmurs which then had preluded their departure. Sometimes they sang a little after emerging, but seldom as much as during the early months of the year; and on many a blustery morning of November they were perfectly silent.

In August, one burrow was suddenly abandoned. Illuminating the interior with the beam of a flashlight, I could barely glimpse the dead body of one of its tenants, seeming to gaze with dull, lusterless eyes upon the outer daylight to which it could never return. The cause of its death must ever remain unexplained, and after this occurrence I lost all interest in the burrow, supposing that it would remain forever deserted. At this period the survivor spent much time calling in the vicinity of the abandoned dormitory. But one day at the beginning of November, while passing before this burrow, I happened to notice the skull of the dead motmot lying in the roadway below the entrance. On looking into the tunnel, I found that the two parallel ruts, made by the feet of the birds while passing in and out, were again sharp and fresh, indicating that it was once more in use. The following morning, waiting beside the entrance, I saw two birds fly forth into the cold, dark, windy dawn. The persistent calls of the widowed one had been at length answered, and he (or she?) had found a new mate. Then

the pair, possibly after a period passed in another dormitory, had cleaned the burrow, and made it fit for continued occupation. But in the middle of December, when I paid my last visit to this burrow, it had only one occupant. Again I can only conjecture what befell the other.

Then there was the burrow which I had watched the motmots dig at the beginning of July. The pair continued to seek its shelter together every night (as far as observations went), until mid-November, when I learned that one of them was no longer there. For two weeks the single bird slept alone, but at the end of that period it found another mate—or could it be that the same mate had returned after an absence? The imperfect glimpses into the lives of the motmots that I received make it impossible to give definite answers to these important questions. Not long afterward, at another burrow, I found three full-grown motmots sleeping together, for the second time in the course of a year. But this arrangement was only temporary, for a week later I learned that the third bird had gone elsewhere. These fluctuations in the number of occupants of each burrow suggest that during the period of the year when the nights are longest in the Northern Hemisphere, the motmots may at times pay visits to the burrows of other pairs, leaving their mates to sleep alone for a while.

Despite these temporary departures, if such they were, the motmots as a rule remained in pairs through the long season during which they did not breed. Because most of the burrows were so crooked, it was impossible to look in from the front and see how the occupants disposed themselves for the night. But one evening in November, darkness overtook me as I passed along a road through the forest still far from my abode; and as I approached a burrow that I had seen many times by day, it occurred to me that I had never tried to look into it during the night. I threw in the beam of my electric torch, and to my great surprise and delight, found that this exceptional tunnel was perfectly straight and I could look right into the dormitory at the end. The ray revealed a rather formless mass of light green in the center of the chamber. It was hopeless to try to distinguish head or tail of a bird, or to decide whether there was one motmot or several. The only distinct objects I could discern amongst the mass of soft, fluffy feathers were some wing plumes, and these but poorly. The sleepers were not awakened by the unaccustomed glare, but when I clucked softly with my mouth at the entrance, one unburied its head from among the green, downy feathers. More clucking, and some whistling were required to rouse the second bird, which faced directly into the light and started to preen its feathers. The two were pressed together so

closely that until they raised their heads it had been impossible to distinguish them. I turned out the light, waited a minute, then peeped in once more, and found that the motmots had already resumed their slumbers with their heads lost among their feathers. They must have felt very secure in their deep retreat not to have been greatly alarmed by the sudden and altogether unprecedented intrusion.

BEHAVIOR OF A YOUNG BIRD

And now that we have followed the adult motmots through the cycle of a year, one additional question remains to be settled. When do the young birds mate and dig their burrows? To this question I can unfortunately give no direct answer. I waited for the appearance of new burrows along the mile or more of roadway that I kept under constant surveillance. Six families of motmots had been reared in the banks along this stretch of roadway—probably about seventeen young birds in all—yet by the end of the year not a single new burrow had been dug there, except of course those which the parents had excavated close beside their old ones. This was not because the banks were overcrowded; there were long unoccupied stretches, including a considerable length of bank which had sheltered a seventh pair earlier in the year, but had been abandoned during March.

All this is not very helpful in answering our question, but I have just one bit of suggestive evidence. At the end of June, Pedro, the little Indian boy who waited table for us, brought me two young motmots which had been hatched very late and could not yet fly. He picked them up beside a stream; but when I returned with him to look at the spot, we could find no burrow from which they might have come, and their origin remained a thorough mystery. I decided to attempt to rear the two foundlings, and to liberate them when they could take care of themselves.

The first evening, it was necessary forcibly to open their bills and drop in the food; but already the next day they began to take particles offered to them with a forceps. One showed considerably greater skill at this than the other. We gave them chiefly hard-boiled egg, elderberries and blackberries. When hungry they called loudly, repeating a note which sounded like *cry cry cry*, and snapped avidly for food. They did not actually reach out and take the food, but merely groped in its general direction, and it was necessary deftly to drop the morsel into their open mouths. They would try to swallow anything with which their gaping bills came in contact, including each other, which was of course impossible. I inferred from this behavior that in the burrow feeding must present a very disorderly scene, were

anyone able to witness it. Probably the light is insufficient for the parents to see their nestlings, and the latter must grope wildly about with open bills, until one of them encounters the food and swallows it; this is all very different from the well-mannered conduct of nestlings reared in the open, which merely stretch up their gaping mouths and wait for the parent to drop in the offering.

When not interested in food, the two foundlings rested, standing in contact with each other. At first, they kept their eyes closed even during the day, as they must do in the burrow. By night, they slept pressed close together, each with its head turned back and buried among the fluffed-out feathers of its back and shoulders. One of the little motmots took its nourishment poorly from the first, and soon succumbed; but the other lived several weeks until it, too, died of some pulmonary infection which it apparently contracted from the domestic chickens.

Before the second motmot died, it learned to perch and fly across the room, and pick up food for itself. When it had acquired these accomplishments, and was probably somewhat over a month old, I surprised it one afternoon behaving very oddly. It descended to the bottom of its box, pecked at the paper covering or at the wall in front, then kicked back rapidly with both feet, sounding a tattoo against the board. At the same time it half-spread its wings and uttered low little murmurs. Now pecking and kicking backward are the chief activities in digging the burrow; can it be that at this early age the instinct to dig a burrow for sleeping was manifesting itself in the little motmot? If this be so, it is not unlikely that the young birds mate and dig their own burrows at the same time as the parents, at the end of June or in early July, when they are between two and three months old and scarcely to be distinguished from the adults. This is the only period in the whole year when I found any burrows being excavated, except once in March, when somebody maliciously plugged the entrance of a sleeping burrow and its evicted tenants were obliged to dig themselves a new one.

This, at least, is my present belief, but it will need to be confirmed by additional facts. I am glad that there still remain some unsettled points in the lives of these retiring birds which will be added incentives to renew my acquaintance with them, should fortune ever lead me back to their mountain haunts.

COMPARISON WITH OTHER MOTMOTS

Although at the first glimpse it might appear that the Blue-throated Green Motmot's lack of racquet-shaped central tail feathers is adap-

tive, in the sense that it represents a toning down of the bird's plumage in response to the more severe climatic conditions of the highlands, further consideration makes this appear unlikely. We may recall that the Quetzal, a highland member of a family most abundant in the lowlands, is by far the most ornate of the trogons. But the differences that have been noticed between the habits of the Blue-throated Green Motmot and its lowland relatives do seem to adapt it to the colder climate in which it dwells.

In the lowlands of Guatemala and Honduras, I found the Turquoise-browed Motmot digging its burrows in April and May; and soon after they were completed, eggs were laid in them. These burrows were in the low, sandy banks of rivers, where it was likely that they would be either flooded or washed away during the heavy rains of the winter months; and they would hardly make safe dormitories during this period. In 1930 and 1932, when I studied these lowland motmots, I was not so interested in the ways of sleeping of birds as I afterwards became, but a nocturnal visit to one nest of the Turquoise-browed Motmot revealed only a single parent sleeping with the eggs. The available evidence points to the conclusion that the burrows of the Turquoise-browed Motmot are in use only during the breeding season, and do not serve as dormitories. Except in their nesting season, I have spent little time in the range of these motmots, and am not sure whether they remain mated through the year.

For Lesson's Motmot I have abundant evidence that, like the Blue-throated Green Motmot, the birds remain paired at all seasons. Once, in southern Costa Rica, I found a pair beginning to dig a tunnel as early as October, in the side of a pit left by treasure-seekers who had uncovered an old Indian grave. So far as I could learn, neither member of the pair slept in this burrow until they began to nest in it in March of the following year. During an earlier October, a pair of these motmots retired every evening to sleep in a coffee plantation beside a house in which I was lodging in the Costa Rican highlands. A careful search through the little plantation failed to reveal a burrow; and although I did not succeed in finding the birds after dark, I concluded that they slept among the bushes. In Costa Rica, Lesson's Motmot ranges from sea-level up to about 5000 feet. In beginning to dig its burrows so many months before the nesting season, this motmot of lower elevations manifests a habit which, by further development, might lead to the Blue-throated Green Motmot's peculiar custom of excavating at the very end of the breeding season the tunnels in which it will nest the following year, and meanwhile using them as shelters against the nocturnal cold of high altitudes.

Among the lowland species, I have watched the excavation of the burrow only by the Turquoise-browed Motmot. Male and female alternate at the task, exactly as with the Blue-throated Green Motmot. At this time one member of the pair, doubtless the male, gives an occasional morsel to his mate. The shape of the motmot's tunnel appears to be determined largely by the character of the soil in which it digs and the number of obstructions it meets. While those of the Turquoise-browed Motmot that I have examined were only slightly curved, once in the Guatemalan lowlands I opened a burrow of Lesson's Motmot that was almost as crooked as those made by the Blue-throated Green Motmot. Hence the irregular form of the latter's burrow appears to be related to the nature of the ground rather than to the climate. (We have referred to an exceptional example that was quite straight.)

The nests of motmots, highland and lowland, are typically unlined, with the eggs resting upon the bare floor or the litter of regurgitated exuviae that has accumulated there, as with kingfishers and jacamars. Gaumer (1881-1882) mentions nests of the Turquoise-browed Motmot, situated in limestone caves and wells in Yucatán, that were composed of "sticks and mud, or grass and mud"; but this statement is so greatly at variance with the experiences of Owen (1861) and myself with another race of the same species that I think it best to withhold judgment upon this point until we have additional information.

In Guatemala and Honduras, the Turquoise-browed Motmot lays four or, less commonly, three eggs which are pure white. In this the observations of Owen in Baja Vera Paz agree with mine made in more humid regions farther east, some seventy years later. Gaumer records from four to six eggs in Yucatán, but in nests whose ascription to motmots has already been questioned. I have opened only a single burrow of Lesson's Motmot—it was a major job of excavation!—and found in it three nestlings.

Both sexes of the Turquoise-browed Motmot take turns at incubation and both join in attending the nestlings. We have already compared the rate of feathering and the length of the nestling period of this bird and the Blue-throated Green Motmot. This species also appears, like kingfishers, to raise only a single brood each year.

Although motmots are often said to be 'stupid' birds, my own studies lead me to quite a different evaluation of their mentality. In lowland districts where they have been little persecuted by man, motmots may be more or less indifferent to his presence; but even here my own experience has been that they incline to be wary. But those species that dwell in higher regions with a dense, bird-destroying

human population—as the Central Plateau of Costa Rica and the Guatemalan highlands—are among the wariest of all birds, and the ornithologist who wishes to learn how they live will more than once be brought to the conclusion that his wits are hardly a match for theirs.

SUMMARY

1. The Blue-throated Green Motmot (*Aspatha gularis*) was studied on the Sierra de Tecpán in the Guatemalan highlands, between 7000 and 10,000 feet above sea-level, from February through December, 1933. The activities of four pairs were followed in some detail, while subsidiary observations were made upon about a dozen others.

2. These motmots remained paired through the year, and at all seasons slept two by two in long, usually very crooked burrows they excavated in steep earthen banks. They entered and left these burrows in the twilight.

3. Although the number of burrows indicated a fairly high population, the motmots were at all times so exceedingly shy and elusive that they would be counted as very rare by any method of taking census not based upon the burrows.

4. The eggs were laid during the first ten days of April, in burrows which had already been in use for months as dormitories. The full set consisted of three eggs, laid at intervals of two days.

5. Incubation was carried on by both sexes, sitting alternately for periods of about three to six hours. Before sunrise, and again at the close of the day, the eggs were left unattended while both parents sought food.

6. The incubation period varied from 21 to 22 days.

7. The newly hatched nestlings were blind and quite devoid of feathers or down. At the age of ten days, they were nearly covered with long, soft, gray down. This was, during the latter half of nest-life, gradually covered over by green feathers of subsequent development, with the result that at the time they left the nest, the young motmots closely resembled their parents in plumage.

8. The downy feathers of these motmots expanded at a considerably earlier age than the plumage of nestling Turquoise-browed Motmots (*Eumomota superciliosa*) in the lowlands. This is regarded as an adaptation to the cooler climate of the highlands.

9. Both parents fed the nestlings, bringing them large hairless caterpillars and other larvae, as well as winged insects. They did not clean the nest.

10. Both parents continued to sleep in the burrow through the whole period of egg-laying and incubation, and with the nestlings

until they were about three weeks old. After this, one or both parents might abandon the burrow as a sleeping place; but one or both parents of other pairs slept with the nestlings until their departure.

11. The young motmots left the burrows at about the end of May, at the age of 29 to 31 days, when they could fly well. The one whose departure was witnessed flew out spontaneously before sunrise.

12. The fledglings were not led back to sleep in the burrows but remained out in the cold rains of this season. The parents usually but not always continued to sleep in the burrows after the fledglings' departure, in some instances resuming this habit when they had interrupted it during the young birds' final nights in the nest.

13. At the end of June, during a lull in the rains, the parents quite generally began to dig new burrows, in the same bank as the old and, in five instances, from 20 inches to 28 feet distant from it. Both sexes alternated in this labor. One pair had a period of working in the morning and another in the afternoon. The young birds did not appear while their parents were at work. The date of digging these new burrows appeared to be determined by the weather, rather than upon the interval which had elapsed since the departure of the nestlings.

14. Upon completion, the new burrows were used as dormitories by the parent motmots, and the old ones remained deserted, or were occupied by Cobán Swallows (*Notiochelidon pileatus*). In no instance was a second brood discovered.

15. During the second half of the year, the motmots continued to sleep in pairs in the burrows. Rarely three birds, or a single one, slept in a burrow; but this condition was temporary and sleeping in pairs was the rule.

16. The behavior of a hand-fed young bird is described. The available evidence suggests that the young motmots mate and dig burrows for sleeping at the same time as their parents dig them—that is, when they are about two months old. This still requires confirmation.

17. The Blue-throated Green Motmot is briefly compared with the Turquoise-browed Motmot and other lowland species. There is no evidence that the lowland motmots use burrows as dormitories; but Lesson's Motmot (*Momotus lessonii*) may begin to dig its burrow about half a year before it lays eggs in it.

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Costa Rica

THE UNDER-WATER ACTIONS OF DIVING DUCKS

BY ALLAN BROOKS

CONSIDERABLE attention has been paid in the past to the actions of various diving ducks when submerged. The earliest records that I can find are those of that painstaking naturalist, William Macgillivray, during the first half of the last century. On this side of the Atlantic, E. H. Forbush has probably written more on this subject than any other author and in his work on the Birds of Massachusetts he has compiled his own records with those of other observers.

For many years past I have endeavored to collect all the information possible from my own observations and to check them with those already recorded. In spite of the fact that diving ducks are especially plentiful on the Pacific Coast and that they are comparatively unmolested there, it has been difficult to get accurate records of healthy, unwounded birds. Crippled birds or those injured in any way must be ruled out, as also must sick birds, especially when these are emaciated.

The chief difficulty is to get well above the birds unobserved by them when they are feeding over a light-colored bottom of sand or gravel. Near my winter home at Comox, Vancouver Island, there are several fairly good vantage points—one where a long pier extends some 300 feet into the sea; another where a near-by vertical cliff overlooks a feeding ground with a bottom largely composed of light-colored sand. But it was not until the past winter, 1944-1945, that I encountered nearly ideal conditions for such observations. This was at Yellow Point on the sheltered inner waters of Chemainus Bay on the east coast of Vancouver Island. Here the house in which I resided was built into the rocky shoreline in such a way that from the front windows numbers of ducks of 12 different species could be seen diving for food directly below and not more than 25 feet away for most of the species

observed. Best of all, the bottom was mostly composed of broken clam shell, clear white under the crystal clear water. Never before had such an opportunity presented itself and I spent hours with a good binocular watching the unsuspecting ducks. Under such conditions, actions that had never before been clearly apparent were noted with absolute certainty. The most notable of these was the rigid extension of the alula in certain species. I have not noticed this action recorded before in any publication though it may be what F. M. Woodruff describes in Forbush's *Birds of Massachusetts*, 1: 279: "The wings were held about one-third spread and perfectly rigid."

It was notable how few species used their wings under water or even expanded them slightly as planes. Of course their almost universal use by wounded birds is known to every duck shooter. Although their extension would seem actually to retard speed, it is probably a reaction caused by excitement or fear.

This applies to ducks and geese and also to loons and grebes. Cormorants use their wings under water when feeding and all Alcidae use them at all times, actually flying under water. An especially tame Murre, *Uria troille californica*, a seemingly healthy bird, dived again and again within 15 feet of my canoe without any apparent action of its feet which were held directed backward, close under the tail, and quite inert as the bird pulled itself under the water with its wings. In the Marbled Murrelet, *Brachyrhamphus marmoratus*, the tips of the wings are the last thing seen as the bird dives, obviously the completion of the wing stroke that pulls the bird under.

The results of my observations on diving ducks are presented as concisely as possible under the heading of each species.

Greater Scaup Duck, *Aythya marila nearctica*.—The commonest duck under observation during the past winter. The wings are never used in any way when under water; they are almost entirely concealed under the ample flank feathers. This applies to all the species of the genus which I have observed and includes most of the European species.

American Golden-eye, *Glaucionetta clangula americana*.—Wings are never used under water but are held tight to the sides beneath the flank feathers. The tail is expanded to its full extent and appears under water to be about as broad as the body. Upon emerging, the tail is held flat on the water or slightly under the surface; at rest, the tail is elevated or even cocked up at an angle when the bird is asleep.

Barrow's Golden-eye, *Glaucionetta islandica*.—Under-water actions are exactly as in the American Golden-eye.

Buffle-head, *Glaucionetta albeola*.—Under-water actions the same as in the Golden-eyes but with an increased agility. No cranny in the

rocks is too deep for it to explore and it searches for its crustacean prey even into dense growths of seaweed.

An attempt is now being made to make the Buffle-head congeneric with the Golden-eyes—see the latest Hand Book of British Birds and the Twentieth Supplement to the A. O. U. Check-List (Auk, 62: 439, 1945). This is a mistake. Its courting actions, color of eggs and several points in its structure are all divergent from the Golden-eyes.

Old-squaw, *Clangula hyemalis*.—Owing to its off-shore habits I have never been able to get above this species when it is diving for food.



Allan Brooks.

TEXT-FIGURE 1.—Golden-eye descending. Note outspread tail.

It seems to open the wings slightly just as it plunges under. Before the dive the tail is held flat on the surface; even the long central streamers of the old male are almost submerged.

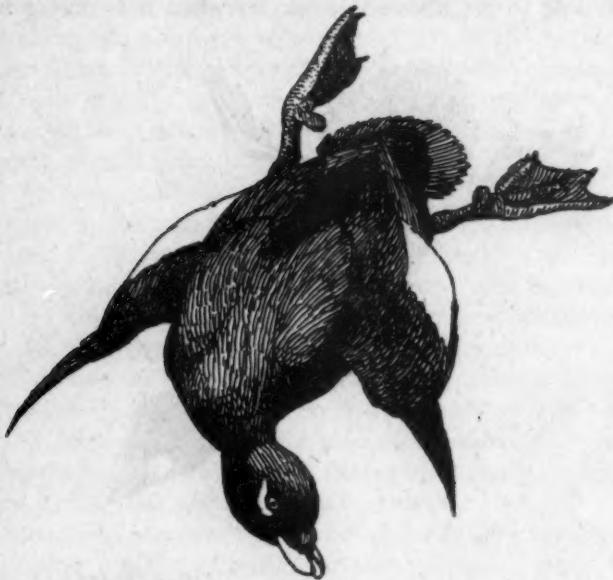
Harlequin Duck, *Histrionicus histrionicus*.—Although I have watched this unique duck for hours, I cannot be sure of its actions under water. It seems to give a flip of its wings just as it plunges forward, as does the Old-squaw, but not always. Like the Old-squaw, it carries the tail flat on the water between dives though it is elevated when courting or at rest.

I cannot find the slightest difference between eastern and western Harlequins and think that the subspecies *pacificus* is founded on second-year and worn-plumaged males; wear would also account for

the supposedly larger bill. These young males can be found throughout the summer in flocks by themselves on the seacoast when the old males are inland at their breeding quarters. As soon as the latter return to the salt water they commence to eclipse.

I will be glad to submit adult males of the Pacific bird to the Committee of the A. O. U. to decide this question.

White-winged Scoter, *Melanitta fusca deglandi*.—The ordinary diving action of the White-winged Scoter is peculiar. The wings are



Allan Brooks -

TEXT-FIGURE 2.—White-winged Scoter. Going down.

flipped forward as the bird plunges, but under water the tips of the primaries can be seen crossed over the tail, the secondaries are somewhat expanded, showing the white patch conspicuously, but the alula is extended to its utmost, giving the appearance of small, sharp-pointed wings held out rigidly on each side during the whole period of the dive. On coming to the surface these winglets are still extended, but I was unable to observe if they were retracted between dives. When resting between dives the wings are still outside of the flank feathers, the carpus submerged, the tail is also slightly submerged, and the primaries show on each side of it. No definite movement of the

wings can be seen when the bird is submerged. As in all the diving ducks the feet appear as huge paddles with a decided lateral action. The ascent to the surface is buoyant and rapid, at an angle of about 45°. To show how dangerous it is to be positive as to the invariability of any action, an adult female of this species always dived with her wings tightly closed and covered by the flank feathers; her mate just



TEXT-Figure 3.—Surf Scoters exploring the bottom.

as invariably employed the above detailed action. The pair was watched carefully over a period of six weeks and there was no variation in their diversity. All the other White-wings that I have observed were normal in diving, with a partially open wing and the alula extended.

Surf Scoter, *Melanitta perspicillata*.—Of all the diving ducks the Surf Scoter has given me the best opportunities for observation; also it was the first to clearly display the extended alula. When first I saw the small, sharp-pointed wings held stiffly extended and pointing de-

cidedly downward I thought I was looking at the entire wing and that the diminution was caused by refraction of the water. Eventually the actual condition became evident and the primaries could be plainly seen held tight to the body with the alula extended to its fullest, pointing outward and downward. It has a slight rowing movement at the commencement of the dive, but not afterwards when the appearance is of small, sharp-pointed wings held rigidly extended and pointed slightly forward and downward while the bird explores the bottom. The winglets are still extended when the duck shoots to the surface at an angle of 45°.

American Scoter, *Oidemia americana*.—As in all its actions, the American Scoter's diving is quite different from that of the other two species. There is no suggestion of any wing movement either before or during the dive. The wings are held tight to the body and covered by the flank feathers, with no extension of the alula. Its contour on the water is always distinctive; the head is held high with the bill horizontal or even slightly elevated, giving a 'chins up' appearance. The courting actions also differ radically from those of the other scoters, especially the courting flights where four to ten males may be seen wheeling about after one female, usually fairly high above the surface of the water, exactly as do the Harlequins which are usually found with them.

Ruddy Duck, *Erismatura jamaicensis*.—All the diving Ruddy Ducks that I have observed held the wings tightly closed and covered by the flank feathers.

Mergansers.—All three species of merganser were observed at Yellow Point, but the Red-breasted was by far the commonest. No wing action of any sort when diving has been observed by the writer, although William Macgillivray and other writers have testified to the contrary. It may be that wounded birds use their wings when under water, but all three species, when diving for food, shoot along beneath the water with a streamlined contour and at a great speed. When hunting for schools of small fish, both of the larger mergansers work in a formation abreast, the heads of all the flock partially submerged with the eyes beneath the surface. On sighting fish, the whole flock plunges forward, beating the water with their wings with the obvious intention of confusing the fish or driving them into shallower water. In the midst of the commotion every bird will suddenly go under, and they can then be seen darting about, twisting and turning after their prey, without any visible wing action.

In conclusion I would like to deprecate any impression of finality in my observations. Different variations in buoyancy, as between fresh

and salt water, may give different reactions, and much more observation is called for. For example, I find it definitely stated in one of my notebooks that Harlequins never use their wings under water, but in subsequent observations a decided flip of their wings has been noted as they plunged under. Probably observation of healthy birds in a glass-sided tank will give the final solutions.

*Okanagan Landing
British Columbia*

BREEDING BIRDS OF THE PIGMY CONIFERS IN THE
BOOK CLIFF REGION OF EASTERN UTAH

BY ROSS HARDY

Plates 23, 24

THE pigmy conifers of the west which are so characteristic of, and cover such extensive areas in, the Great Basin and the Colorado River drainage provide shelter for a number of interesting avian inhabitants. Between September 1, 1935, and May 21, 1938, the writer had the opportunity to make studies of the birds inhabiting sample areas of the extensive pigmy forests which skirt the base of the Book Cliffs in Carbon County, east-central Utah. These pigmy conifers, consisting principally of Utah juniper (*Juniperus utahensis*) and double-leaf piñon (*Pinus edulis*), cover large areas of the foothills which are in turn skirted by open flats and valleys of salty soil bearing stands of shadscale (*Atriplex confertifolia*) and greasewood (*Sarcobatus vermiculatus*) or similar saltbushes.

Two separate areas were selected for intensive study—one at Sunnyside, 6700 feet, near the upper altitudinal limits of the pigmy conifers (September 1, 1935 to June 7, 1936); the other near Price, 5567 feet, extending up over the foothills from 5800 feet to 6500 feet, nearer the lower limits of growth (August 25, 1936 to May, 1938).

The writer is indebted to Dr. A. M. Woodbury of the University of Utah and to Mr. Harold Higgins of Price, Utah, for assistance in connection with this study.

METHODS

Data were obtained by observation and collection of specimens upon frequent visits to and through the areas. Observations were facilitated by the use of eight-power binoculars. Of the specimens of skins, nests and eggs taken, the majority are in the writer's collection and a few at the University of Utah. A total of 1557 notes on field observa-

tions were filed in chronological order, and later transcribed and arranged in a separate systematic file.

CLIMATE

Considerable variation in climate can be tolerated by the pigmy conifers as shown by their vertical range of over 3000 feet. The U. S. Weather Bureau records (Alter, 1931: 18) show that there is little difference in annual mean temperature between Price and Sunnyside. Both places have a much greater precipitation in late summer and early fall than at any other time.

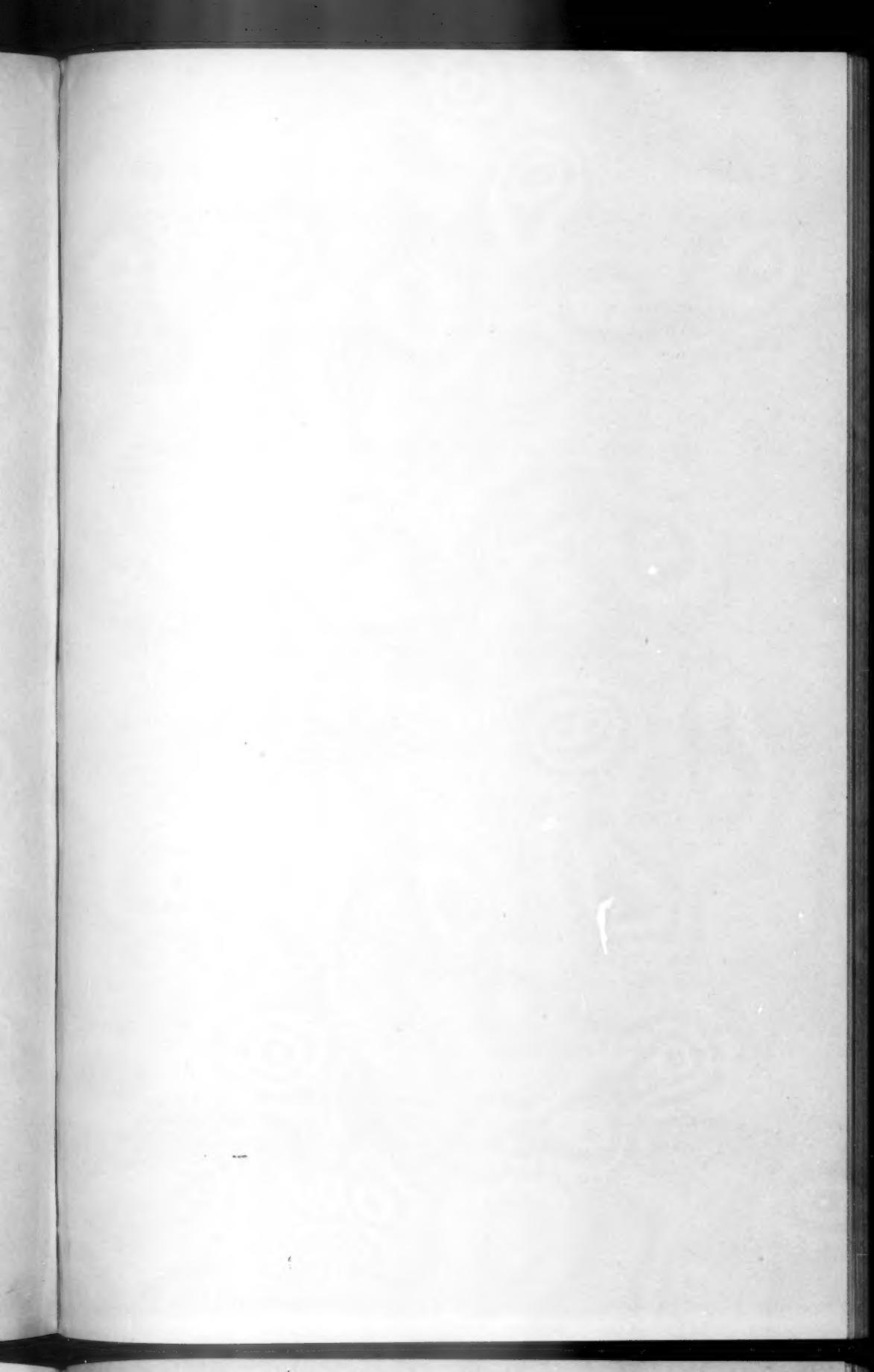
Comparative data show the mean annual rainfall at Sunnyside to be 13.5 inches; Price, 10.6 inches; and the Utah state average, 12.9 inches; the annual mean temperature at Sunnyside, 47.4° F.; Price, 47.8° F.; Utah, 48.0° F.; average maximum temperature at Sunnyside, 58.8° F.; Price, 63.5° F.; average minimum temperature at Sunnyside, 36° F.; Price, 32° F.; highest recorded temperature at Sunnyside, 96° F.; Price, 108° F.; lowest recorded temperature at Sunnyside, -10° F.; Price, -31° F.

Precipitation studies (Alter, 1931: 3) in the region show that precipitation increases with altitude at the rate of about one inch for each 328 feet. Alter further indicates that Price receives "relatively light precipitation because situated to the lee of the Wasatch Mountains. Sunnyside at the south edge of the Tavaputs Plateau of mountainous height, draws a good precipitation from summer thunder showers." "April, May and June are usually the driest months, June being most dependably driest. July, August, September and October are the wettest months at most places in the section, September being the most dependably wet everywhere."

THE PIGMY CONIFERS

The chief visual characteristic of the pigmy conifers is their scattering, squat, bush-topped, stunted appearance. The junipers and piñons, which make up the bulk of the vegetation, usually run from ten to twenty feet in height and in general are widely spaced because their shallow root systems are relatively larger than their crowns. Within the limits of moisture tolerance of these plants, the ratio of root system to crown appears to vary inversely with soil moisture; the less the soil moisture, the more widely spaced are the crowns.

"The vegetation of this belt (Juniper-piñon) shows clearly that the small precipitation is one of the important factors limiting growth." (Tidestrom, 1925: 12). Sampson (in Tidestrom, 1925: 27) states "That limiting moisture, rather than excessive heat units or inferior





BOOK CLIFFS REGION, UTAH.—(Upper left) ROCKY SLOPES AND PIGMY-CONIFER-COVERED MESAS SKIRTING THE BOOK CLIFFS SEEN ABOUT TEN MILES IN THE DISTANCE. (Upper right) PIGMY CONIFERS, SHOWING STUNTED CHARACTER AND OPEN SPACING. (Lower left) JUNIPER (left) AND PINON TREES (right foreground) SHOWING TYPICAL SPACING IN DENSE AREA OF PIGMY CONIFERS. (Lower right) NEST AND EGGS OF PINON JAY IN A PINON TREE.

soil, is responsible for the limited growth of plants of this belt is made clear from the fact that all species which occur along watercourses grow more luxuriantly," and indicates that the second most important factor is the shallowness of the soil, a "factor which limits the density of the vegetative stand and its luxuriance of growth. Both precipitation and depth and fertility of soil increase as one goes to higher altitudes."

The lower limit of the pigmy conifers in the areas studied is usually marked by the line where the shallow, well-drained soils give way to the deeper salty soils of the valleys. The upper limit, however, appears to be set by increasing soil moisture where it permits a deciduous broadleaf chaparral type of vegetation to replace the pigmy conifers. This is indicated on the slope of the mountains near Sunnyside (at about 8000 feet) where, at the same altitude, the junipers and piñons occupy the drier south-facing slopes and the scrub oak (*Quercus gambeli*) and serviceberry (*Amelanchier alnifolia*) occupy the northerly slopes where snow persists longer and is deeper in winter.

Junipers are usually more numerous than piñons, although they vary from place to place. Counts on several small areas indicated a proportion of piñons running from 17% to 48%. The general average proportion in a transect about thirty feet wide and containing over a thousand trees was 26.4% piñon.

Interspersed in the spaces among the trees, sagebrush (*Artemesia tridentata*) is abundant and matchweed (*Gutierrezia* sp.), June grass (*Bromus tectorum*), and wheat grass (*Agropyron* spp.) are common. In certain areas, the cliff rose (*Cowania stansburiana*) occurs. Flowering herbs that are conspicuous include red skunkflower (*Gilia aggregata*), several *Penstemon*, a number of *Astragalus*, many species of *Eriogonum*, and numerous Cruciferae.

The pigmy conifers are found mostly upon the three- to five-mile-long, flat-topped mesas which extend from the Book Cliffs southward to the still more arid areas of the shadscale lowlands. The sloping sides of these mesas lead about 300 feet down to the saltbush flats. Price is situated at the southern edge of one of these mesas known as Woodhill, while Sunnyside is 26 miles northeast in the mouth of Whitmore Canyon of the Book Cliffs.

The edges of the mesas are often cut into pinnacles and ledges which provide shelter and nesting sites for birds. These may be from twenty to over a hundred feet high and are usually of a poor grade of loosely bound gravel conglomerate or crumbling blue slaty clay which makes it nearly impossible for one to climb them to study the avian inhabitants nesting there.

PROBLEMS OF THE ENVIRONMENT

The pigmy conifers place limitations upon the birds that can live under their influence through limitations in such necessities as space, food, water, shelter, protection, nesting material and nesting sites. The crops of juniper berries and pine nuts and the seeds of the inter-spersed plants are about the only products directly usable as food by the birds. Indirectly, however, the scanty resiniferous foliage, the tough wood, and the roots of the junipers and piñons, as well as similar parts of the minor plants, yield food for insects or rodents which in turn are used by the birds.

Most nesting birds choose junipers in preference to piñons for nesting trees, probably because natural cavities in trunks suitable for nesting sites occur much more frequently in junipers than in piñons. Wood-peckers can bore into juniper limbs which they often find decayed internally, but only occasionally find suitable places in dead piñons. The erect habit of growth of the piñons seems to offer few horizontal limbs to support the slovenly nests of such birds as Mourning Doves, whereas junipers frequently provide such nesting sites. The stringy, fibrous bark of the juniper seems to be the most characteristic nesting material furnished by the pigmy conifers although dried Russian thistle is often used.

Because of aridity, the pigmy forest and near-by areas support comparatively little plant life. Those plants which do grow are small-leaved desert forms which support a minimum of insect life. This means that birds nesting in such an area must claim a large territory to obtain enough food for their young. Territories of species nesting in near-by shadscale areas, however, were almost always larger than territories of the same or similar species of bird nesting in the somewhat more densely vegetated piñon and juniper areas.

Erosion, originally slow because of aridity, has been accelerated by overgrazing. Erosion is slowly wearing away the mesas to form cliffs and rocky slopes which serve as niches for birds nesting there. Fire often clears areas by destroying the pigmy forest. The succeeding growth of thistles and June grass is followed, after a great length of time, by wheat grass and sagebrush, which is later replaced by juniper and piñon.

Timidity seems to accompany this lack of cover, for the chief defense of these desert birds appears to be one of flight rather than one of concealment. Aridity affords less plant life to serve as cover than is provided by the greater amount of moisture higher in the mountains.

Waterfowl and similar birds are excluded from the pigmy forest by

absence of water, although they occasionally fly over such areas. Some birds such as swallows and Robins, which need mud for nests, are likewise excluded from breeding. Pheasants are excluded because of the lack of drinking water, but the Mourning Dove can and does fly great distances to obtain water.

Man's entrance has undoubtedly caused a diminution in number of those birds which are found only in natural arid areas. Such residents as the Piñon Jay and the Titmouse are obligate inhabitants in the pigmy forest. The destruction or changing of this area may cause hardship to them. The desert birds are reduced in numbers by irrigation. Such birds as the Desert Sparrow, the Piñon Jay, or the Titmouse are not found in cultivated regions, but they probably occupied such areas before irrigation began.

The excessive grazing of the area by livestock has, in many cases, reduced plant life to a minimum. This, without doubt, makes itself felt by a decreased yield of seeds and insects which serve as food for the birds. Undoubtedly the introduction of Russian thistle has changed the landscape to a tremendous degree and has probably changed the habits of birds. Horned Larks, Juncos and other seed eaters often, in winter, feed upon this plant instead of upon the seeds of grasses. Restoration of plant cover helps to restore some of the bird life, for birds seemed to be much more common in a large fenced, protected area on Woodhill than in the near-by overgrazed areas.

THE BIRDS OF THE PIGMY CONIFERS

A permanent home among the junipers and piñons can be found by some birds that are able to face the extremes of winter cold and storm and of summer heat and drouth, as well as the more optimal conditions of other times. This implies that they breed here and raise their young and are more or less obligate birds of the pigmy conifers.

Having a lesser degree of dependence upon this habitat, some birds breed here and migrate south for winter. Others merely pass through in migration and stop en route for resting and feeding. The pigmy trees give much more adequate protection and shelter than do the shadscales of the valleys and flats.

Some birds winter in the pigmy conifers and go elsewhere to breed. They migrate either to higher elevations (altitudinally) or to areas farther north (latitudinally). Other birds nest near by in other habitats and enter the area primarily to forage, while still others pass over the pigmy forest in migration without stopping.

Of the 125 species found in this and near-by areas, 79 have been observed in the pigmy conifers. Of these, eight may be classed as perma-

manent residents but only three of these are obligate birds of the piñons. The other five depend upon favorable nesting sites formed by the cliffs at the edge of the mesa. Fourteen summer residents and seventeen winter visitants have been recorded. All others are considered as migrants or foragers from near-by areas.

OBLIGATE PERMANENT RESIDENTS

Three species of birds are found throughout the year in the piñon conifers and are known to nest in these trees, and hence may be called permanent residents. The Piñon Jay (*Cyanoccephalus cyanocephalus*) and the Gray Titmouse (*Parus inornatus ridgwayi*) are not known to nest in the Book Cliffs Region, except in the trees, and thus are considered obligate birds of the piñon conifers. The Lead-colored Bush-Tit (*Psaltriparus minimus plumbeus*) also nests in these trees but occasionally nests in ponderosa pines at higher elevations and thus is considered a semi-obligate bird of the piñon conifers.

Nesting in colonies, but sometimes with one or two pairs nesting separately from the main flock, the Piñon Jay is one of the most conspicuous and noisiest inhabitants of this area. Varying in numbers at different seasons, a flock of over fifty jays occupied the piñon conifer area near Price.

Courtship among the jays seemed to be under way on April 3, 1937, for many of the jays were pairing off, separate from the flock. One would often strut before another bird which would fly a short distance to settle down and again watch the demonstrating partner. On this day, one jay flew from a small, densely-leaved piñon which contained a half-built nest of sticks and juniper bark. This nest was never finished, although it bore the marks of recent work and did not resemble the weathered ramshackle nests remaining from previous years.

Near by, on April 17, 1937, two jays were carrying sticks and juniper bark to another nearly completed nest which was built next to the upper part of the trunk of a piñon. This nest was also later abandoned. Within fifty feet of it, on April 24, a third nest was found, well out on the end of a juniper limb. When discovered, an adult flew. The nest contained one egg. On each forenoon of three succeeding days, another egg was deposited. These four eggs were incubated until May 7, when they were deserted. The adults were not again seen in this place.

Young stubby-tailed jays were found in groups of three, four or five perched on limbs of trees about one and one-half miles northeast of this place on May 15. Recently-abandoned nests within a quarter-mile radius indicated that a large colony had nested. The jays nested

in this same area the following year and had nearly all left the nest by April 9, 1938. Of eight nests discovered, three contained young with pin feathers in tail and wings. By April 15, all but those in one nest had flown. After the mild winter of 1938, these young seemed to be more than three weeks earlier in their development than were the young hatched following the extremely severe winter of 1937.

The Piñon Jays nest on the limbs or in large branches while the Gray Titmouse prefers small cavities in the tree trunk or behind the bark. The Bush-Tit usually builds a pendent nest on the end of a limb. The two smaller birds are not colonial in their nesting habits. Thus there is likely no competition among these three species for nesting sites.

Competition between Titmice and white-footed mice for nesting sites possibly takes place. A Titmouse was heard chattering and scolding for nearly an hour as it hopped about in a juniper tree May 27, 1937. This incident was repeated in the same place two days later. In a crevice in the trunk of this tree was found a nest constructed almost entirely of juniper bark. A white-footed mouse (*Peromyscus maniculatus sonoriensis*) was captured in this nest on May 31. It is not known whether this was a mouse nest or a Titmouse nest, but the incident suggests the possibility of competition between these two animals for favorable nesting cavities.

Nesting of the Bush-Tit likely takes place between April 25 and July 15, for this species seemed nearly to disappear from the area at that time. On May 21, 1938, in a pigmy conifer area near the LaSal Natural Bridge south of LaSal Junction in San Juan County, a pendent nest of a Bush-Tit was found in the top of a piñon tree. It was made almost entirely of sheep's wool and contained five white eggs which, judging by their opaqueness, seemed ready to hatch. No nests were located in the area near Price, but the troops of parent and young were common during the latter part of July.

Titmice are found in a family group of a half dozen or so for a short time in the period after the young leave the nest. One immature titmouse was observed begging food from another, presumably a parent, on June 11, 1937. During most of the year, however, Titmice are found singly, in pairs, or a few with flocks of Bush-Tits or Chickadees. Bush-Tits, on the other hand, are commonly found in troops of six to thirty.

Among the Piñon Jays, in early June, each family seemed a separate unit within the larger social group—the flock. Each group of three or four young was accompanied by one or two adults to feed and guide them. The entire flock of Piñon Jays was seen to move down the

slopes to the shadscale flats on June 8, 1937. Here they spent much of their time during the following ten days. One morning I walked across the shadscale flats between one of these family groups and the rest of the flock. At once, this family arose from the ground where it had been feeding and flew to a distant lone juniper. The adult alighted in its sheltering branches but the young continued their flight beyond until a sharp squawk from the parent—almost a command, it seemed—caused them to wheel in mid-air and return to the juniper. Later, at another call from the parent, they flew very high overhead and returned to the main flock. In early July, these family lines were not so evident and the group seemed one large unit—the flock.

The population of this colony of jays appeared to more than double during the nesting season, but the total number prior to nesting seemed to remain about the same each year. Occasionally during the winter, dead jays were seen in the snow, but other than this no fatalities were observed. When a Horned Owl approached the nesting area just before sunset, May 15, 1937, thirteen adult jays, cawing loudly and flying constantly about its head, drove it for nearly a mile westward. Groups of jays seem to be able to repel one owl, but since the owl is nocturnal, it could likely prey upon jays if they were found at night. The remains of a Piñon Jay in the stomach of a Red-tailed Hawk was reported by Bent (1937: 172). This hawk is rather common in the area but it has never been seen to attack the jays, although the remains of Mourning Doves and Nighthawks were seen in a Red-tail nest.

The adult Piñon Jays are likely omnivorous in their habits. Usually because of individuals which seemed to act as sentries, it was impossible to approach closely enough to determine the exact nature of the food consumed. One young jay was observed to flutter its wings and beg food. An adult placed food in its mouth and flew to the top of a tree where it ate juniper berries. This may have been the kind of food previously fed to the young.

The small insects and similar food found on the leaves and small twigs by the Bush-Tits is likely largely unavailable to the much larger Piñon Jays. Bush-Tits spend much time feeding from the outer limbs and needles of the piñon conifer trees. The Titmouse spends its time mostly in the larger branches and on the trunk of these same trees. Piñons seem to be more favored than junipers as feeding places. In December, the digestive organs of the Titmouse contained much gravel and bits of piñon leaves.

PERMANENT RESIDENTS NOT LIMITED TO THE PIGMY FOREST

Five species of birds are found nesting in the cliffs and high gravel banks around the edge of the mesa. Since all of these birds hunt for food over rather large areas, their presence in this area is attributed to the favorable nesting sites which are found along the edge of the mesas between the pigmy conifers and the lower-lying shadscale areas. It may be significant that all of these except the omnivorous American Raven (*Corvus corax sinuatus*) are birds of prey: the Western Red-tailed Hawk (*Buteo jamaicensis calurus*), the Eastern Sparrow Hawk (*Falco sparverius sparverius*), the Golden Eagle (*Aquila chrysaetos canadensis*), and the Montana Horned Owl (*Bubo virginianus occidentalis*).

The cliff-nesting birds are known to find different kinds of nesting sites but in the Price area they nested only on the ledges and cliffs. The Raven is said to nest elsewhere in Utah in piñon trees, but since cliffs are available in the pigmy conifer area of the Book Cliffs, it likely prefers the latter situation to tree nesting.

A Golden Eagle nest was located halfway up a hundred-foot ledge on a shelf below an overhanging bulge on April 10, 1937, in a pigmy conifer area of the Farnham Dome twelve miles east of Price. With some difficulty, a position was found upon the cliff where one could look with a binocular into a portion of the nest. One egg could be seen, but it was impossible to determine more. The parents were hunting the piñons and shadscale flats below. Golden Eagles are not common enough to be observed over the pigmy conifers at all times, but this species seems to be a permanent resident of the area.

Some competition for favorable nesting sites and for food may possibly exist between the Red-tailed Hawk and the Golden Eagle since their habits are very similar. In the Emma Park area of the Book Cliffs, about ten miles north of Price, on June 5, 1937, an eagle was observed as it was driven from what was likely the nesting area of Red-tailed Hawks. Two of these usually slow-flying birds were surprisingly agile as they flew at the head of the eagle which quickly left their territory.

The account of the nesting habits of the Red-tailed Hawk and its unusual nest upon an isolated pinnacle has been published separately (Hardy, 1939: 79). In the area studied, these birds were not found nesting other than on pinnacles or upon protruding shelves of cliffs.

Nest construction by a pair of American Ravens began March 20, 1937 when they were flying in and out of a crevice in the "Cracked Ledge" near Carbon High School. This ledge has a hollow just beneath the rim of the harder rock which covers Woodhill, and into this

cavity the birds carried sticks, wool, and juniper bark. They usually flew in opposite directions on their foraging expeditions and returned about the same time, welcoming one another with hoarse caws.

The raven nest, lined with juniper bark and an inner lining of sheep's wool, contained no eggs on April 11. At 5 P. M. the following day, there was one pale blue egg. The nest was being incubated by one raven at dusk on April 15 at 7 P. M., while the other bird perched in a crevice about ten feet away. When disturbed, this bird flew straight out, paused in mid-air as it fanned its wings, and turned its head to look before circling around and flying away. A second egg was present April 19. At noon, April 23, the nest had been filled with stones. The ravens were not to be seen, but a near-by pile of empty shotgun shells carried its own suggestion. July 15, two ravens were seen flying about this ledge. No nest was built here during 1938, but during the spring of 1939, it was reported to me that another nest in the same place met a similar fate.

Nesting in small crevices of crumbling slate or gravel ledges at the mesa's edge, the Sparrow Hawk is common in the pigmy conifers throughout the year. During May, the young could be heard below the ledge. On July 9, about fifty feet from one of these pinnacles where they had likely been hatched, five young hawks were seeking shelter from a summer thunderstorm by crouching on the ground beneath a juniper. Inasmuch as these birds nest in small crevices and are mainly insectivorous in habit, they likely do not compete with the larger Red-tailed Hawk or Golden Eagle.

An adult and two young Horned Owls were hunting on Woodhill, June 24, 1937. When disturbed, they flew into a crevice back of a high blue-slate ledge where an adult had been frequently observed earlier in the year. Their nest was believed to have been in this dark crevice. During another daytime expedition, these owls flew down a small canyon when they were disturbed. House Finches and Blue-birds sent forth a continuous cry of alarm which rolled like a wave ahead of the owls, probably warning other inhabitants of the pigmy conifers. Because of nocturnal habits, these birds likely avoid competition with the other cliff-nesting species of this area.

The problem of avoiding excessive exposure to the sun was likely more difficult of solution for young Red-tailed Hawks than for the other cliff-nesting birds which were in crevices or otherwise located in shady niches. The hawks nesting on the top of a pinnacle were seen to move out of the nest at 33 days of age (June 19, 1937) and cling precariously to a few sticks on the edge of the pinnacle where they were on the north side, in the shade of the tall, bulky nest—the only



BOOK CLIFFS REGION, UTAH.—(*Top fig.*) ROCKY SLOPES AROUND BASE OF PIGMY CONIFER FOREST, OFTEN NEARLY BARREN; A TYPICAL NESTING AREA FOR THE ROCK WREN. (*Middle fig.*) JUNIPER TREE AT EDGE OF A SAGE-COVERED FLAT; A NESTING SITE FOR THE MOUNTAIN BLUEBIRD. (*Bottom fig.*) LEDGES AND PINNACLES AT EDGE OF MESA; BARE, ROCKY SLOPES IN BACKGROUND. A NEST OF THE RED-TAILED HAWK ON PINNACLE IN THE FOREGROUND.

shade on the pinnacle. This was repeated during June 22. A large branch of jointfir (*Ephedra nevadensis*), observed in the nest on June 24, may also have been placed there to help shade the young birds. On June 26, the young hawks were again in the nest, evidently enjoying the sunshine, because the weather was cooler after the rain of the previous night. The extreme heat of the previous week was over. On July 6, at 50 days of age, one young hawk had flown to a near-by dusty area and was seen taking a dust bath.

The food of the young hawks, in addition to numerous jackrabbits and blowsnakes, consisted of Nighthawks and Mourning Doves, remains of which were observed in the nest. No prairie-dogs (*Cynomys leucurus*) were seen in the nest, even though these rodents are abundant in the area near the nesting site. Red-tailed Hawks were observed feeding upon Uinta ground-squirrels (*Citellus armatus*) ten miles north, in the aspen area of Emma Park.

NESTING SUMMER RESIDENTS

Fourteen species may be classed as summer residents, nesting in the pigmy conifers. Four of these are not abundant. The Broad-tailed Hummingbird (*Selasphorus platycercus platycercus*) is encountered occasionally during the summer as it feeds from some of the numerous flowering annuals. One nest was found in a piñon in Huntington Canyon, Emery County, in 1932, but no nests were found near Price, although because of its habits it is presumed to nest there. The Ash-throated Flycatcher (*Myiarchus cinerascens cinerascens*) which usually nests in trees has been observed near Price two times. On July 10, 1937, two of them were seen in mating antics as they alighted in a juniper and then continued their flight northward, deeper into the pigmy conifers. Say's Phoebe (*Sayornis saya saya*) is sometimes found feeding in the conifers during the summer. It likely nests on the nearby ledges, but no nests were taken from this area. At higher altitudes, near the cliffs at Sunnyside, a few specimens of Cañon Wren (*Catherpes mexicanus conspersus*) were taken. They possibly nest in that area.

The ten other summer residents of the pigmy conifers may be divided into four groups upon the basis of their nesting habits. These are birds nesting in tree cavities, those nesting in or on limbs of trees, those nesting upon the ground, and those nesting in cavities in or beneath rocks.

Cavities made by winter-visiting woodpeckers in living junipers are commonly utilized by the Mountain Bluebird (*Sialia currucoides*) for its nests. Nest construction may not begin until April although the birds arrive between January 28 (as they did in 1938) and February 29 (as in 1936), depending upon weather conditions.

Nesting material was being carried into one of these juniper cavities on April 24. The hole was too small to allow one to feel the nest and it would have been impossible to move part of the trunk without great destruction—hence the exact condition of affairs in this tree could not always be ascertained. On May 13 the birds were incubating, but on May 28 they were carrying food into the nest. On June 1 the young were noisy when the entrance of the nest was touched. The young were outside the nest, June 14. Twelve days later the male was again incubating. On July 10 the second brood seemed to have hatched. No adults were seen near the nesting cavity after August 6. Large flocks of Bluebirds were foraging throughout the pigmy conifers after the first brood had left the nest.

All Bluebird nesting cavities studied were in living junipers from three to five feet above the ground and all but one were holes made the previous winter. Bluebirds nest in cultivated areas and higher in the mountains in the aspens but are unable to nest in the shadscale and greasewood areas because of the lack of cavities. They are thus confined to areas where there are plants large enough to furnish nesting cavities.

Likely both the Horned Owl and the Sparrow Hawk are enemies of the Bluebird for this species is alarmed when either of the two appears. The Red-tailed Hawk does not seem to alarm Bluebirds in the same way as do these birds of prey.

Six species of birds are known to nest in the foliage or on the limbs of trees in this scrub forest. The American Magpie (*Pica pica hudsonia*) often nests in colonies, but individual pairs may nest separately from others. Two groups of nests formerly used by Magpies but unoccupied at the time of this study were all that was left of a fairly large Magpie population, thanks to "sportsmen." A newly constructed nest in a piñon was found April 10, 1937, on the Farnham Dome, ten miles east of Price. The bottom of the large bundle of sticks was lined with mud and rootlets and contained three eggs of a brown-mottled, bluish color.

Four half-grown young Magpies were in a nest discovered in a cottonwood tree near an irrigation canal at the edge of the pigmy conifers four miles west of Price on May 28, 1937. These and a few stragglers observed between March 20 and November 11 seemed to comprise the remnants of a once fairly abundant Magpie population.

The Western Gnatcatcher (*Polioptila caerulea amoenissima*) is known to saddle its felt-like nest upon a small branch in the trees of the pigmy conifer areas of Tooele and Washington counties of Utah, but no nests were taken in the Price area. It is presumed to nest in this

area because twenty-six different entries on as many different days record different places where the species was observed between May 8, and August 6, 1937. It was not observed in any other habitat than in the pigmy conifer area.

A female Black-throated Gray Warbler (*Dendroica nigrescens*) was observed feeding a young just out of the nest on June 19, 1937, in the pigmy forest near Price. This female kept up a continual sharp chipping as she fidgeted about in a piñon tree; meanwhile she gathered soft-bodied insects, having layer after layer hanging from her bill at one time. A male that approached was repulsed by her, but a second male which came near a minute or so later and gave a few chirps of alarm was hardly noticed by the female. She busied herself gathering insects from the tufts of piñon needles and was seen to be without her food after a visit to one particularly thick cluster. In this piñon tuft was found a young bird just out of the nest.

When discovered, the young bird jumped to the ground and tried to escape by hopping through the thistles while the female set up a great fuss, chattering and fluttering her wings. She did not try to feign an injured wing. It is interesting to note that this bird did not try to conceal the presence of her young by swallowing her food in the presence of an observer as did female Mountain Bluebirds, Desert Sparrows, and Lark Sparrows.

This warbler was common from May 1 to late July and was observed in no other area than in the pigmy conifers.

The Common House Finch (*Carpodacus mexicanus frontalis*) occurs in the Price area throughout the entire year. However, it was not found in the pigmy conifers during the winter months—that is from September 1, 1936, until April 11, 1937. Large flocks of these finches congregated in the box elder trees around the town and farms where they fed upon the dried seeds during the cold weather. They were known to nest in the town as well as sparingly in the conifer area. Almost any tree which provides thick cover near the ground—within a few feet—seemed to be used for the nest.

A nest of the House Finch contained four eggs on April 25. The last of these hatched May 8. After the young had left, this nest was remodeled and contained three eggs on May 25, but the nest was empty the next day. A female finch was seen carrying a twig through the pigmy forest on June 29, but she dropped it after she had been watched for about ten minutes. This was believed to be intended to help repair a nest for a second brood. A male was observed feeding a young one which begged food by approaching him and fluttering its wings on July 13.

Western Chipping Sparrows (*Spizella passerina arizonae*) reappeared April 17, 1937, but the males were not distributed into territories and singing from their individual perches atop conifer trees until May 8. Occasionally Brewer's Sparrows (*Spizella breweri breweri*) were seen in the flocks, but they were not known as nesters in the pigmy conifers of this area, although they did nest in greasewoods on the more arid flats below.

Chipping Sparrows were carrying nesting material on May 24, while on the same day other individuals were seen copulating. Young were observed out of the nest on June 22 while near-by adults were copulating for a second brood. A nest containing two young sparrows was located where it was well hidden on the brushy tip of a piñon limb. This nest was made with an outer supporting framework of dried Russian thistles and was lined with vegetable fibers and horsehair, although it was built in a fenced area from which grazing had been excluded for over two years and horses had not been allowed within two miles. Eight days later the nest was empty. Flocks of young were seen in many places in the forest where they were being fed by adults.

The kinds of seeds and insects consumed by Chipping Sparrows are undoubtedly eaten by other species of birds, thus likely helping to reduce the numbers of birds living in any area. A Chipping Sparrow was seen chasing an insect from one sagebrush to another when a Mountain Bluebird flew down and caught the insect before the sparrow was able to overtake it. The sparrow pursued the bluebird through the air until the food had been swallowed, whereupon the sparrow returned to its original perch.

The Western Mourning Dove (*Zenaidura macroura marginella*) is very adaptable in its nesting habits. It has been found to nest beneath sagebrush on the ground, in cavities in cliffs, and on the upper surface of horizontal juniper limbs as well as in the thick, matted limbs of a greasewood. The majority of them in the Price area nested upon the large, horizontal branches of living junipers. No nests were found in piñons, probably because the more erect branching of this tree does not provide satisfactory sites for slovenly Mourning Dove nests.

The return from the south was noticed on April 19 when the doves reappeared on the shadscale flats near Price, but they were not seen in the pigmy conifers until a week later.

A Mourning Dove nest was discovered on a large horizontal branch of a juniper about four feet from the ground on May 8. It was made of a few dried grass stems and contained the usual two eggs. The

incubation period was determined to be equal to, or greater than, sixteen days. The two young hatch within two days of one another, indicating that incubation is continuous after the first egg is placed in the nest. At least two broods were raised during the season. Birds that hatched in one nest on May 29, 1937, flew after but a ten-day period. The last brood of doves found left its nest on August 5 and the doves were not observed in the pigmy conifers after September 1.

Protection of the young from sun and rain is provided by one of the adults which usually remains on the nest during a large part of the day. Despite this, one young was killed in its nest by a hailstorm. The adults seem to rely upon their protective coloration which greatly resembles the gray color of the dead limbs upon which they nest. They fly only when approached within a very few feet. The adult will try to distract attention by the pretense of having an injured wing. One individual that fluttered from the nest in extremely 'crippled' fashion was seen to approach the nest in a circuitous manner a few minutes later, but upon observing that the writer was still in the vicinity, immediately it again became 'crippled'. Red-tailed Hawks fed upon Mourning Doves. The antelope ground-squirrel (*Citellus leucurus pennipes*) destroyed eggs in one nest.

Ground-nesting birds, other than the ubiquitous Mourning Dove, include the Western Lark Sparrow (*Chondestes grammacus strigatus*) and Howell's Nighthawk (*Chordeiles minor howelli*). The latter can hardly be called a nester since it simply deposits its eggs upon the ground beneath a tree.

During the courtship period of early June, immediately after the arrival of the Howell's Nighthawk, these birds fly during the daytime. A *whirrrzz* sound is made as the air rushes through their wings when they dip upward at the end of a long vertical dive and then give a sharp vocal *peep*. From early June until early July, two birds are often flushed from beneath the same tree during the daytime, but later in the summer only one bird is found in a given place. The neutral, broken pattern of the Nighthawks is a very effective protective device since they are very difficult to find unless they move.

One egg was found on the ground beneath a juniper on the morning of July 2, 1937. This one egg was incubated until July 15, after which the adult was no longer seen. Whenever this adult was flushed during the period of incubation, she flew very low, fluttering below the tops of the pigmy conifers as if to escape the notice of a near-by, omnipresent Sparrow Hawk. It is thought possible that she may have fallen victim to one of these small hawks or perhaps a Red-tailed Hawk since Nighthawk remains were observed in the nest of the latter.

Two newly hatched birds were found beneath a juniper on July 10. These baby Nighthawks remained in the same place until seven days later. They grew rapidly while the dark pin feathers pushed through the buff-colored down and when last seen they were able to walk with a queer, rolling motion, with wings held aloft. The last young observed in this area left the nest on July 21. Five nests were found. One contained one egg, two had one young each, and two had two young in each.

Sixteen or eighteen pairs of Nighthawks were usually visible at one time in the evenings, early in the summer, as they flew over the pigmy conifers. Later in the summer the birds were not observed to fly and hunt their food in pairs and the flock seemed to be larger, undoubtedly because of the addition of young. Very few Nighthawks were present after September 15, 1937.

Male Lark Sparrows appeared in the area on May 8, and selection of territories began soon after. From the top of a high sagebrush or a lone tree, they poured forth their songs from daylight until dark and occasionally even afterward. This species favored the area where sagebrush-covered flats adjoined the thick conifers.

The nest of the Lark Sparrow, sunken slightly in the ground and hidden beneath a pile of dried thistles or a matchbush, was made of small sticks and juniper bark and lined with horsehair and vegetable fibers. Usually the nest is placed at the edge of a clearing, but one was found in the thick conifers.

Eggs were deposited in the morning, one on each of consecutive days. One nest contained one egg on May 23 and its full clutch of four on May 26. All of these hatched on June 6 (incubation period: 11 days) suggesting that during the laying period they were not under constant incubation. However, each time this nest was visited during the laying period, an adult was flushed from the nest. Ten days after hatching, these young left the nest although they were not completely feathered.

The young sparrows hide in the sagebrush and thistles and are fed by the adults. Moths, grasshoppers, and caterpillars seem to comprise the main items of food carried by both parents to the young who quickly come out of concealment at their approach.

The nests observed were not used for a second brood although it seems that another brood is usually raised. On July 6 a nest contained two eggs and a third egg was added the next day. On July 17 two eggs hatched and the next day the remaining egg was missing from the nest. The nest was vacant after the young had been in the nest nine days.

After the young of the first brood have left the nest, all territorial areas seem to be broken down. Flocks, each comprising a family, wander at will. Occasionally a female will be courted by more than one male and there may be minor skirmishes for possession. This seems to take place until new boundaries are set up. The female may be entirely inattentive while she is engaged in carrying grasshoppers to the young, but this does not stop the male from singing and fluttering about her. While the young are in the nest, the male assists in the task of feeding, but when they can fly well, which is about fifteen days after they have left the nest, he no longer helps.

Small cavities beneath rocks and similar semi-underground situations are favored by the Common Rock Wren (*Salpinctes obsoletus obsoletus*) for its nesting activities. This bird returned April 10, 1937, after having been missing from the pigmy conifer area near Price since the previous November 7. Nest construction took place early, for some eggs hatched before May 18, 1937. Nests of Rock Wrens were found on rocky slopes near the pigmy conifers and on the near-by shadscale flats. Usually a tunnel from six to twenty inches in length leads to the nest. The numerous characteristic pebbles were placed at each nest entrance. One nest built on the near-by shadscale flat under a large, somewhat isolated rock had small lengths of broken shadscale stems substituted for the pebbles.

The nest which was decorated with sections of stems contained eight eggs on June 24. These all hatched the morning of July 8 after being incubated a few hours more than fourteen days. After the young had left, this nest was destroyed by an antelope ground-squirrel before it could be used for a second brood.

Six young Rock Wrens were in another nest when it was discovered May 18. These young left the nest May 26. This nest was not occupied by a second brood. Yet another nest discovered May 24 contained seven eggs which hatched June 6. The young left the nest June 20. A second brood occupied this nest; the first egg was deposited July 20 and one each day thereafter until the sixth on July 25. Incubation did not start until the last egg had been deposited and all eggs hatched the afternoon and evening of August 7 (incubation period: 14 days). The nest was again empty August 22.

The young wrens scatter through the rocks and conceal themselves after they leave the nest. When the second brood is being incubated and fed in the nest, the first brood passes into the pigmy forest to feed. Between mealtimes, the five to eight young return to the area near the nest.

Usually all of the wren eggs hatch, but one nest discovered June 26

contained an egg which failed to hatch. The other five eggs hatched July 2 and the wrens were feathered out when they left the nest July 13, leaving the unhatched egg which was still unbroken.

A pair of wrens raising two broods of six to eight per brood would increase the population fourteen or more so that the number of wrens is greatly increased by autumn. As far as can be determined, most of them leave the area in the autumn, but about the same number that inhabited the area the previous spring reappear the following spring, thus suggesting a high mortality rate during the autumn and winter.

Enemies of the Rock Wren possibly include the striped racer (*Masticophis taeniatus taeniatus*), which is common in the area, and possibly the desert wood rat (*Neotoma lepida*), which builds its nest beneath rocks in the same areas. The snake would likely prey upon such birds as it could obtain, while the rat would destroy or replace the nests with its own structures. The antelope ground squirrel probably is also destructive to these birds.

NICHES

In order to support a large number of species of birds, it is necessary that an environment supply a number of habitats so that each kind of bird may find its own particular niche where it can successfully rear its young. Should two species of birds be too similar in all their habits it is likely that one will be crowded out by the other. This is chiefly avoided by differences in nesting and feeding.

Each of the twenty-two kinds of breeding birds observed evidently has its own niche. It was impossible to delineate exactly all of the habits and factors which allow these many forms to inhabit successfully this desert area, but significant ones have been pointed out where possible.

Eight kinds of birds were able to live here throughout the year, of which five were attracted by the favorable nesting sites offered by cliffs. These five avoided competition with one another because they chose different sizes of cavities for nests, because one of them is nocturnal, because another is omnivorous in its feeding habits, because another feeds largely upon insects, because of differences in their size, and for many other less apparent reasons. The three obligate residents avoid competition by differences in food and feeding habits as well as differences in nesting.

Some birds, such as the hawks and owls, prey upon other birds, although birds evidently do not form the principal item in such diets.

Fourteen summer residents were able to find food such as flowers, seeds, and insect life, in spite of the harshness of this arid area. These

avoid competition by leaving the area during the winter when their kind of food is less abundant. They find at least four different kinds of nesting sites and avoid competition in food getting because one feeds from flowers, another catches its insects by flying with wide-open mouth in the higher levels, others feed upon insects caught on the wing in flycatcher fashion, some obtain caterpillars and similar forms from twigs, others get insects from the bark of trees, many find food upon the ground, while still others rely mostly upon seeds.

As an example: the Mountain Bluebird was seen to catch flying insects from the air much like a flycatcher. Thus it may rival the Phoebe. It was observed in active competition with the Chipping Sparrow. Even though there is this overlapping, this cavity-nesting thrush finds its own particular niche and is able to maintain itself in this area.

SUMMARY

1. This is a report upon the pigmy conifer forests of the arid Book Cliffs region of eastern Utah and some of the habits of the twenty-two species of birds which breed there.

2. Some birds favor a permanent home in the pigmy conifers and face extremes of aridity, heat, frost and other weather conditions throughout the year. These species breed here, raise young and can be called obligate birds of this plant association. These are the Piñon Jay, the Gray Titmouse, and the Lead-colored Bush-tit. These birds differ in their methods of feeding and nesting in the same area, and thus each finds its own particular niche.

3. Their presence determined more by rocks and cliffs for safety in nesting than by pigmy conifers, the Western Red-tailed Hawk, Golden Eagle, Eastern Sparrow Hawk, Montana Horned Owl, and American Raven are permanent residents in this area.

4. Fourteen other species of birds are summer residents of the pigmy conifers. Of these, four were scarce in the region. Most of these are passerine birds and are primarily insect and seed eaters that, in winter, are unable to find sufficient food of the proper kind and hence must migrate from here and return at the winter's end. They nest in cavities in trees, in the limbs of trees, on the ground, and beneath rocks upon the ground.

5. Each kind of bird has one or more characteristics which cause it to differ from the other birds in the area and hence it is able to survive with them because of this partial elimination of competition. Such habits as food getting, nesting, incubation periods, and similar adaptive activities are listed when observations permit.

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THE BARBETS

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THE Capitonidae or family of barbets is found throughout the tropical regions known as the Ethiopian in Africa, the Indian, including the Indian, Indo-Chinese and Indo-Malayan subregions in Asia, and the Neotropical region in the New World. The family is not easily defined. In general it may be said that the Capitonidae are zygodactylous perching birds with ten tail feathers. The wings and tail are rounded. The bill is stout and strong with the culmen having a tendency to curve and with the tip pointed.

In most cases these birds present rather a squat, stubby appearance. The perching position tends to be straight up and down. Almost all the species are found in areas of high trees, either deep forest or old gardens. Some forms range high into the mountains over seven thousand feet. Others are exclusively lowland dwellers. Barbets excavate their nests after the fashion of woodpeckers, usually in rotten parts of tree trunks. However, one genus, *Caloramphus*, is said to excavate nesting holes out of termite nests, and an African form is reported to nest in holes in the ground—(*T. margaritatus*) *vide* Friedmann (1930: 463). As in woodpeckers the bill is used in excavating, and the attitudes and climbing habits in trees often closely resemble those of the Picidae, even to the use of the tail as a support.

As with most tropical birds, the nesting season tends to be variable and drawn out. Barbet's eggs are white and rounded, thin-shelled and rather glossy. The flight of these birds is fluttering, often appearing clumsy, and not long sustained. Their calls are, for the most part, characteristic harsh monosyllables uttered over and over, *i. e.* the Asiatic "coppersmith," although other species utter low whistles or soft wailing notes.

These birds are primarily fruit eaters with a secondary diet of insects, particularly during the breeding season. In captivity, barbets are great meat eaters. Most species are colonial in habit only inadvertently at times of fruiting of certain trees. However, two closely related genera—*Caloramphus* in Asia, and *Gymnobucco* in Africa—are colonial by preference.

POSITION

Sharpe (1900) placed the Capitonidae as follows: Order PICARIAE, Suborder SCANSORES, as a member of the first group of that suborder which contained the Picidae, Indicatoridae, Capitonidae and Ramphastidae. His reasons for this are primarily the anatomical ones proposed by Seehoem (1890). He separated this group from the second in the suborder, containing the Galbulidae and Bucconidae on the characters of tufted oil gland and lack of caeca in the first group, and nude oil gland and developed caeca in the second.

Stuart Baker (1927) followed Pycraft in the following arrangement: Order CORACIIFORMES, Suborder PICI with the six families as above but listed in a different sequence, with the Ramphastidae following the Galbulidae and Bucconidae, and the position of the Capitonidae and Indicatoridae reversed. The characters of the order are the arrangement of the plantar tendons of the foot and the large size and tubular shape of the gall bladder.

Wetmore (1940) proposed the following arrangement based primarily on Gadow: Order PICIFORMES, Suborder GALBULAE, Superfamily CAPITONOIDEA containing two families, Capitonidae and Indicatoridae.

It is my feeling after studying these birds, that the members of the GALBULAE hardly deserve familial rank. I should be inclined to list two families for the suborder as follows: Superfamily GALBULOIDEA; Families Galbulidae and Bucconidae; the latter to contain three subfamilies, Bucconinae, Capitoninae and Indicatorinae.

HISTORY

The barbets are an ancient family consisting of two large groups with almost no interrelationship in Asia and Africa and one small group in Tropical America. Based on the size and diversity of the group, the origin of this family should probably be looked for in Asia. One branch of relatively unspecialized barbets, having become isolated from the main group, has evolved into two principal types in Tropical America. Another branch, a relative of which is still found in Asia, has evolved into a series of types in Africa culminating in the stout-

billed forms with tooth-like serrations on the maxillary tomia. Isolated and distinctive types appear in all three continental areas.

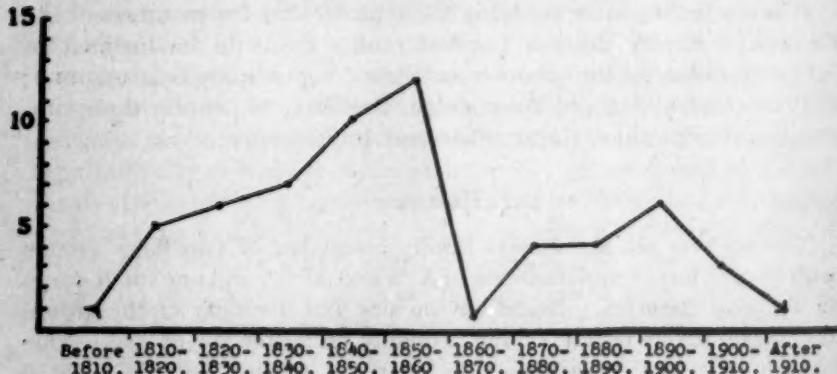
In the following pages I have adopted a linear arrangement which, though far from satisfactory, expresses what I feel to be true about the relationships of this family; namely that, except for the *Caloramphus*-*Gymnobucco* relationship and consequent link, each group of genera in each continent is primarily only closely related to the other genera in that continent. In this arrangement I shall differ from that of the Marshalls' 'Monograph' (1870-1871).

In the following discussion, particular thanks are due to Dr. Herbert Friedmann who read the manuscript and helped with much advice, and Dr. James Chapin whose comments on the African genera were of particular value.

THE GENERA

The early taxonomic history of the family was marred by considerable confusion over the proper generic names. *Bucco* Brisson (1760) and *Capito* Vieillot (1816) were considered by Bonaparte (1850) to represent two families rightly enough, but he completely reversed the family names. By 1855 and Gray's 'List of Genera in the British Museum,' a considerable degree of order had emerged. Charting the number of genera described for this family during the past century and a half gives an interesting result (Text-fig. 1).

Gray (1840) recognized five genera in the family although at least nineteen were then described. Bonaparte (1850) recognized eleven genera in line with the increase in names. However, Schlegel (1863) recognized only three all-inclusive genera, a procedure well in line



TEXT-FIGURE 1.—The actual numbers of genera described within each decade are represented on the chart; thus twelve was the greatest number described in the boom decade between Jan. 1, 1850, and Dec. 31, 1859.

with the conservatism represented in the appearance of new names during that decade. The Marshalls in their elaborate 'Monograph' (1870-1871) list thirteen genera in three subfamilies. By the time of the British Museum 'Catalogue' (1891) the number had risen to nineteen. Present regional lists recognize approximately twenty-two genera. Of these, seven, or over thirty per cent, are classed as monotypic.

THE SPECIES

The number of species of barbets has had a relatively simple progression from small to large to small again. Latham (1782) lists seventeen species. Bonaparte (1850) has increased this to fifty-five. The Marshalls (1870-1871) recognize seventy-seven species, while Shelley in the 'Catalogue' (1891) raises this to one-hundred and nine. Present regional lists recognize approximately eighty-three species, a decrease of about twenty-five per cent due to the institution of subspecies. About sixty-five per cent of the presently recognized species are polytypic.

Looked at from the speciation point of view, the barbet family represents a fairly cohesive entity. The distribution of colors of plumage follows a similar pattern throughout the group. Almost all species have some bright colors—green, red, blue or yellow—although at least one species in each continental area is dull and brownish. In each region there are specializations, notably of the bill. Each continent has at least one species with a grotesque and swollen bill. In the Ethiopian region the relations of this end point of development are still present. In the other regions the immediate relatives have disappeared. In the Ethiopian region also there are some species with specialized patches of bristles and areas of naked skin about the head.

REGIONAL ARRANGEMENT

In each continental region, evolution has proceeded within a distinct range of characters. That is why it seems more logical to group the inhabitants of each region together. These may be listed roughly as follows:

I. NEOTROPICAL REGION

A. *Capito* group—Brightly colored species of medium to small size with rather simple bills. Almost all are sexually dimorphic. This complex of species inhabits a rather limited range, essentially similar in all cases, on either side of the Andes from Colombia to northern Perú, and extending in some cases to the east as far as Amazonia and the Guianas. This group represents reinvasion after reinvasion of

closely allied species, indicating, when translated into taxonomic terms, few genera but many species.

B. *Semnornis* group.—Species with swollen, highly developed bills and soft, rather fluffy plumage, which lack pronounced sexual dimorphism. This group is found only in the highlands in two rather widely separated areas. Thus from the speciation point of view these species represent isolated survival forms of which the connecting links to other barbet species have disappeared.

II. INDIAN REGION

A. *Psilopogon* group.—A monotypic species with a high developed bill, soft plumage, and pronounced bristles, which nearly lacks sexual dimorphism. A montane species; the bright green color of the plumage is the only character borne in common with the other Indian barbets. As in the *Semnornis* group in the Neotropical region, this seems to be a relict form.

B. *Megalaima* group.—A uniform assemblage of species characterized by bright and gaudy plumage, predominantly green with a variety of color patches about the head and throat—black, red, blue, orange and yellow—prominent bristles and a strong stout bill. Sexual dimorphism is not pronounced. Some species are heavily streaked on the under parts. This group inhabits the Indian, Indo-Chinese and Indo-Malayan subregions. It has reached the Philippines, but has not crossed Wallace's Line. Like the *Capito* group above, the group represents reinvasions of closely allied species, which again should be represented by few genera but many species.

C. *Caloramphus* group.—A monotypic genus characterized by dull brown plumage, a sharply ridged bill, lacking prominent bristles and with reduced sexual dimorphism. A colonial species which ranges over Malaya, Sumatra and Borneo with no apparent close relatives in Asia.

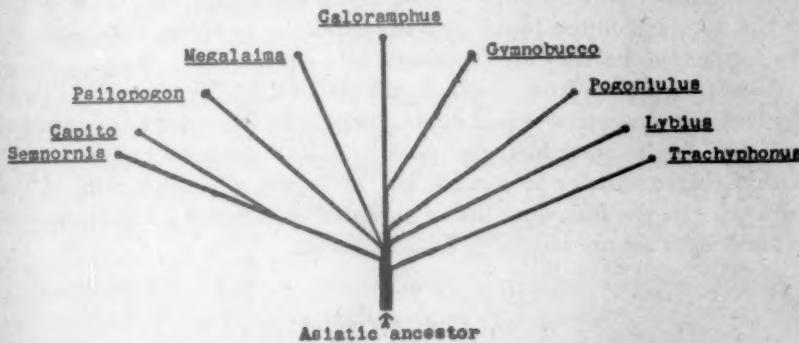
III. ETHIOPIAN REGION

A. *Gymnobucco* group.—Dull-plumaged species with reduced feathering on the head, patches of bristles about the bill, sharply ridged bills, and with reduced sexual dimorphism. Colonial in habit, these birds are found in western Africa from Liberia to west Uganda and seem to form a link between II, C. above and the following African groups.

B. *Pogoniulus* group.—Species of varied plumage and medium to small size, with feathering on the head. These species are more or less transitional between *Gymnobucco* and *Lybius*. In all of them the

culmen is ridged, particularly at the base. One species departs from the barbet rule by having a rather pointed wing. There is virtually no sexual dimorphism. These species range across central Africa from west to east.

C. *Lybius* group.—Species with bills in various stages of specialization, all having one or more 'teeth' on the edges of the upper mandible. The plumage of these species is mostly bright with red, yellow and blue-black predominating. Some species are dull-colored with large areas of white plumage. Sexual dimorphism is much reduced. There is a continual cline in the development of the bill from *melanocephalus*, possessing a relatively simple bill with very small 'teeth,' to *dubius* in which there are two pairs of 'teeth,' and both mandibles are



TEXT-FIGURE 2.—A suggested barbet family tree.

deeply sulcated. These species range across tropical Africa without close relatives in other areas.

D. *Trachyphonus* group.—Species with strong but relatively un-specialized bills, rather longer in proportion than the characteristic barbet bill. These birds have bright spotted plumage, a noticeable degree of sexual dimorphism, and long tails. The wing-tail ratio runs from 86% to 97% in *Trachyphonus*, while in *Psilopogon* or *Capito*, the other long-tailed genera of barbets, the wing-tail ratio is never over 85% or 65%, respectively. The size, proportions and color of this group as well as the suggestion of ground-nesting habits (Friedmann, 1930) incline me to the belief that *Trachyphonus* may represent a link with the *Bucconidae*.

THE TROPICAL AMERICAN BARBETS

In the following list I have used only two genera, *Capito* and *Semnornis*. The genus *Eubucco* was erected by Bonaparte (1850) for the

species *richardsoni*. Except that those species listed in *Eubucco* by Cory (1919) are smaller than those of *Capito*, I can find no valid distinctions between the two. Besides having rounded tails and a tendency to sexual dimorphism, both groups have similar bills and the plumage of both is often streaked on the lower parts. I think Shelley (1891: 107) was quite right in reducing *Eubucco* to synonymy.

Dicrorhynchus Carricker (1910) was proposed for the species *frantzii* because of the slight reduction in size of the bill and the plainness of the plumage as compared to *rhamphastinus*. It seems to me illogical and unnecessary to separate these two monotypic forms. The bill is highly evolved and of a unique type in both. It is far better in this case to emphasize the resemblance between the two than the difference. In spite of its somber plumage, *frantzii* has the bright metallic feathers at the nape which are found as a nuchal collar in *rhamphastinus*. In the former species they are prolonged into a crest.

Semnornis differs from *Capito* in the swollen, highly evolved bill and the lack of pronounced sexual dimorphism. Both genera have rounded tails and similar wing formulae, and in both the external nares are set within ridges, similar in form if not in degree, on either side of the culmen. In the following list of accepted subspecies those forms not examined by me are indicated by an asterisk.

I. *Capito* Vieillot

1. *aurovirens* (Cuvier)

Range: Colombia (La Morelia), eastern Ecuador, northwest Brazil and eastern Perú.

2. *maculicoronatus* Lawrence

Subspecies and range: a. *maculicoronatus*—western Panamá; b. *pirrensis*—southeast Panamá and adjacent parts of Colombia; c. *rubrilateralis*—western Colombia; d. *squamatus*¹—extreme southwest Colombia (Ricaurte) and western Ecuador.

3. *quinticolor* Elliot

Subspecies and range: a. *hypoleucus*—Cauca-Magdalena area, north-central Colombia; b. *quinticolor** southwestern Colombia in the coastal zone.

¹ The fact that this form has a reddish orange forehead, white spots on the secondaries, and a reduction of color and spotting on the under parts does not seem significant enough to maintain it as a separate species.

4. *niger* Müller

Subspecies and range: a. *niger*—Guianas and north bank of Amazon near Obidos, Brazil; b. *aurantiicinctus*—Venezuela; c. *intermedius*—upper Río Orinoco west of Mt. Duida; d. *punctatus*—western Colombia, Ecuador and Perú east of the Andes; e. *macintyrei**—Río Pastaza, Oriente of Ecuador; f. *auratus*—northeastern Perú; g. *orosae*—northeast Perú on the right bank of Río Marañón near Río Orosa; h. *conjunctions**—eastern Perú, Pozuzo; i. *insperatus*—Moyobamba, Perú; Río Chaparé, Bolivia; j. *bolivianus*—lower Río Beni of Bolivia; k. *nitidior*—western Brazil north side of the Solimões; l. *amazonicus*—western Brazil from Solimões to Rio Purus; m. *novaolindae*—western Brazil, left bank of Rio Purus; n. *arimae*—western Brazil, lower Rio Purus; o. *hypochondriacus*—western Brazil, upper Rio Negro; p. *dayi*—Rio Madeira, western Brazil; q. *brunneipectus*—Río Tapajoz, north-central Brazil.

For discussions of these races see Chapman (Amer. Mus. Novit. no. 335, 1928), and Bond and de Schauensee (Proc. Acad. Nat. Sci. Phila., 95: 214, 1943). Further collecting may show that some of these races are merely color phases.

5. *versicolor* Müller

Subspecies and range: a. *richardsoni*—central and eastern Colombia and eastern Ecuador; b. *nigriceps**—Perú, junction Apiyacu and Amazon; c. *coccineus** Puerto Yessup; Junín, Perú; d. *auranticollis*—eastern Perú and western Brazil; e. *steeri*—Moyobamba, Perú; f. *glaucogularis*—central Perú in Huánuco; g. *versicolor*—southeast Perú and Bolivia.

6. *bourcieri* Lafresnaye

Subspecies and range: a. *salvini*—Costa Rica and western Panamá; b. *occidentalis*—western Andes of Colombia; c. *bourcieri*—central Colombia; d. *aequatorialis*—western and central Ecuador; e. *orientalis*—eastern Ecuador; f. *tucinkae**—southeast Perú.

II. *Semnornis* Richmond1. *frantzii* Sclater

Range: Costa Rica and western Panamá.

2. *rhamphastinus* Jardine

Range: Colombia and Ecuador.

THE ASIATIC BARBETS

The Asiatic barbets have been carefully reviewed by Berlioz (1936). In this paper (p. 32) he gives the following key to the genera:

1. *Caloramphus*: loral bristles obsolete; bill strongly keeled at the base of the culmen; plumage dominantly brown.
2. *Psilopogon*: very well developed loral bristles, and with elongated nasal bristles, terminally red; culmen not keeled; plumage dominantly green; tail long and very tapered.
3. *Megalaima*: simple black loral bristles, a few nasal plumules; under tail coverts red; tail of medium length, slightly graduated.
4. *Chotorea*: bill notably longer than tarsus, strong and black (adults); under tail coverts green; exposed nares.
5. *Cyanops*: bill shorter than tarsus or otherwise, pale in color; size medium (wing 90 mm. or longer); second primary noticeably shorter than tenth, loral bristles not longer than culmen.
6. *Mezobucco*: size smaller (wing shorter than 90 mm.); second primary generally much longer than tenth or, otherwise, loral bristles very long, longer than culmen; feet gray or greenish.
7. *Xantholaema*: feet clear red; loral bristles short and strong, not longer than bill.

It is certainly not difficult to agree with the separation of the first two listed genera from the others. I have given their generic characters in the discussion under Regional Arrangement. Also the suppression of *Thereiceryx* Blanford (Berlioz, tom. cit.: 32) seems sensible on the basis of being too close to *Cyanops*. The only characters previously separating these genera were the brown-streaked head, neck and breast of *Thereiceryx* (*vide* Stuart Baker, 1927: 102). However, *Cyanops flavifrons* represents a transitional stage between solid color and streaking.

The question of the distinctness of the remaining five genera is very much open to doubt. As Shelley (1891: 13) expressed it for the whole of the family: "scarcely one of the genera is so well defined that it does not form a link toward some other genus." *Megalaima* Gray (1842) is a new name for *Bucco*. In his subsequent list of the genera of birds (1849) Gray, rightly enough I think, includes in *Megalaima* some twenty-nine species, all of which except *virens* have since been put in *Chotorea*, *Cyanops*, *Mezobucco* or *Xantholaema*. In their monograph, the Marshalls (1870-1871) followed approximately the same arrangement as Gray. Reading over Berlioz's key as listed above, it is diffi-

cult to see how the subsequent genera were created. In every case the characters invoked merge or are transitional.

As an example of the preceding statement, the culmen of the two species of *Megalaima* noted by Berlioz (tom. cit.: 34) seems to be somewhat more arched than in most of the other species. However, by tracing the bill of *M. virens* and superimposing on it a similar tracing of the culmen of *corvina* (a species listed under *Chotorea*) it is seen that the difference in the arc (from the base of the culmen to the tip) between the two is not more than one degree measured from the basal angle between the nares. Comparison of a series of bills of *Megalaima virens* indicates that this difference falls within the standard deviation and is not significant. Other bill characters of *M. virens* are that it is more compressed, less tumid than in two species, *chrysopogon* and *javensis*. However, there is a complete transition between these two forms when the species *zeylanicus* and *faiostictus* are considered.

In the case of the differences enumerated above between *Megalaima* and *Chotorea*, I submit that the presence or absence of red under tail coverts is not sufficient for generic rank, nor is that of exposed nares. *M. virens* has largely exposed nares. I cannot therefore see the validity of *Chotorea*.

Cyanops and *Xantholaema*, like *Chotorea*, were created by Bonaparte (Conspectus Volucrum Zygodactylorum: 12, 1854). These names are listed on the page followed by a group of species in a manner suggesting the arrangement of subgenera. Shelley (1891: 55, 61, 88) has simply given the genotype in each case as the first-listed species after each name. The characters listed by Shelley (1891: 15) and by Berlioz for these genera are in most cases neither valid generic characters nor will they hold good in every case. The culmen of the species *mystacophanes* is not always longer than the tarsus and yet the species is placed in *Chotorea*. The species *franklinii* has a black bill which equals if not exceeds the tarsal length, and yet it is listed in *Cyanops*. It seems impossible, therefore, to accept *Cyanops*.

Mezobucco Shelley (1889) was created for the species *duvauceli* on the basis of a culmen shorter than the tarsus, a pointed, not obtuse, bill as in *Xantholaema*, and the rictal bristles which surpass the bill in length. Berlioz adds to this the wing measurement (less than 90 mm.) and the second primary. None of these characters appears to be valid. The culmen of some species listed in *Cyanops* is shorter than the tarsus, and also the wing of these birds (*i. e.*, *flavifrons*) is shorter than 90 mm. The rictal bristles of other species (*i. e.*, *mystacophanes*, *rubicapilla*) also exceed the culmen in length. Finally in *flavifrons*,

again, the second primary is not shorter than the tenth. Thus it seems impossible to maintain *Mezobucco* as a genus.

Xantholaema is characterized as having rictal bristles that do not exceed the length of the bill. Unfortunately this is not true in any of the species assigned to it. I cannot uphold the genus on the character of red feet any more than of red under tail coverts. I feel that this genus also, as with the preceding three, should be united in *Megalaima*.

Megalaima, then, can be characterized as a genus of Asiatic barbets ranging in size from large (for a barbet) to small, with stout tumid bills, the culmen of which is somewhat arched but never keeled; with green predominating in the plumage and usually with bright patches of color about the head; with rounded wings and tails; and with stout, brightly colored feet. Sexual dimorphism is not pronounced. The arrangement of the Asiatic genera follows:

III. *Psilopogon* S. Müller

1. *pyrolophus* S. Müller

Range: Mountains of Malaya and Sumatra.

IV. *Megalaima* Gray

1. *virens* (Boddaert)

Subspecies and range: a. *marshallorum*—northern and eastern India in the Himalayas; b. *magnifica*—Assam; c. *clamator*—hills of northern Burma; d. *virens*—southern Burma, Thailand, Indo-China in Tonkin, upper Laos and northern Annam and China from Yunnan to Anwei and Kiangsi.

2. *lagrandieri* Verreaux

Subspecies and range: a. *lagrandieri*—Indo-China, Cochin China, Cambodia, southern Laos and south Annam; b. *rothschildi*—Indo-China, Tonkin south to Napé in Laos and Lung Lunn in Annam.

3. *zeylanica* (Gmelin)

Subspecies and range: a. *kangrae**—India, western Himalayas, Kangra to Garwhal; b. *caniceps*—Allahabad east to Bengal, Orissa, Hyderabad and Madras Presidency (?); c. *inornata**—western Madras Presidency and Nilgiris (?); d. *zeylanica*—southern Travancore and Ceylon; e. *hodgsoni**¹—Assam, Burma except the northern part, Thailand, northern Malaya, Indo-China except Tonkin and north Annam; f. *lineata*—Java, Bali.

* I do not recognize the race *intermedia* (Baker).

4. *viridis* (Boddaert)

Range: south-central India, more commonly in the hills.

5. *faiosticta* (Temminck)

Subspecies and range: a. *faiosticta*—northeast and eastern Thailand through southern Indo-China; b. *praetermissa*—Indo-China in upper Tonkin and Laos, southern China (?) and Naochao Is., south Kwantung.

The following groups of species show close relationship to each other although in many cases their ranges overlap. Thus by definition they cannot be called superspecies. In some ways the distribution of these barbets is reminiscent of that of the Polynesian fruit pigeons of the *Ptilinopus purpuratus* group (Ripley and Birckhead, Amer. Mus. Novit., no. 1192, 1942). No color characters are constant enough even to warrant their separation into discrete species groups. For example, such characters as the occurrence of two reddish or orange spots on each side of the lower throat occur in six species belonging to three possible different species groups. I have simply arranged these species in a linear order running geographically from west to east, in each case putting what I consider closely related strains close together. I have started with those species which have rather plain, uncolored throats secondarily suffused in some cases with a yellow patch on the upper portion. From those I have gone to the species with pale bluish throats, sometimes suffused with yellow, and with red spots on either side of the lower portion.

6. *franklinii* (Blyth)

Subspecies and range: a. *franklinii*—Nepal, Sikkim, eastern Assam, the Chin hills and east to southern Yunnan and northern Annam, upper Laos and upper Tonkin, Indo-China; b. *ramsayi*—central and eastern Burma from the southern Shan States to Mt. Mouleyit in Tenasserim, northern and western Thailand; c. *trangensis*—mountains of Trang, peninsular Thailand; d. *minor*—mountains of Malaya; e. *auricularis*—highlands of southern and central Annam and central Laos, Indo-China.

7. *chrysopogon* (Temminck)

Subspecies and range: a. *chrysopogon*—southern peninsular Thailand, Malaya and Sumatra; b. *chrysopsis*—Borneo.

8. *corvina* (Temminck)

Range: west and central Java.

9. *asiatica* (Latham)

Subspecies and range: a. *asiatica*—Kashmir east through Nepal, Sikkim, eastern Bengal, Assam, northern Burma south from the Arakan to the western Shan States, southwest Yunnan and northern Thailand; b. *rubescens*¹—Manipur and Lushai Hills, eastern Assam; c. *davisoni*—in Burma from the Pegu Yomas south to central Tenasserim, western and central Thailand, southeast Yunnan and Indo-China in Tonkin and northern Laos and Annam; d. *chersonesus*—peninsular Thailand.

10. *incognita* Hume

Subspecies and range: a. *incognita*—Amherst to Tavoy, Tenasserim; b. *euroa*—southeast Thailand and Cambodia, Annam, Laos and Tonkin in Indo-China.

11. *oorti* (S. Müller)

Subspecies and range: a. *oorti*—Malaya and Sumatra; b. *anamensis*—south Annam and lower Laos; c. *faber*—Hainan; d. *sini*—Kwangsi, China; e. *nuchalis*—Formosa.

12. *monticola* (Sharpe)

Range: mountains of Borneo.

The following species, which also have red patches on either side of the lower throat, are, in general, distinguished by more gaudy, brighter plumage. The green, particularly of the upper parts, is shiny and darker, rather grass green. The bill is black and large in proportion to the body.

13. *mystacophanes* (Temminck)

Subspecies and range: a. *mystacophanes*—Tenasserim from Tavoy south, peninsular Thailand, Malaya, Sumatra and Borneo; b. *ampala*—Tana Bala, Tana Massa Is., west Sumatra.

14. *rafflesii* (Lesson)

Subspecies and range: a. *malayensis*—peninsular Thailand, Malaya and Banks, Billiton and Mendarau Is.; b. *rafflesii*—Sumatra, Borneo.²

15. *javensis* (Horsfield)

Range: Java.

The following species have rather soft green plumage and orange-yellow on the crown as a patch or fringe.

¹ Not seen; possibly an erythristic form.

² These races vary only in size.

16. *flavifrons* (Cuvier)

Range: Ceylon.

17. *armillaris* (Temminck)

Subspecies and range: a. *henricii*—peninsular Thailand, Malaya and Sumatra; b. *brachyrhyncha*—north Borneo, lowlands; c. *pulcherrima*—Mt. Kinabalu, north Borneo; d. *armillaris*—west and central Java; e. *baliensis**—east Java and Bali.

The species following which I have not examined should possibly be considered a link between the previous forms and *australis* as noted by Berlioz (*tom. cit.*: 50).

18. *robustirostris** (Stuart Baker)

Range: northern Cachar, parts of Assam and possibly Burma.

19. *australis* (Horsfield)

Subspecies and range: a. *cyanotis*—Sikkim to Assam and Burma except Tenasserim; b. *stuarti*—Tenasserim and peninsular Thailand; c. *invisa*—northern Thailand; d. *orientalis*—southeast Thailand and Indo-China except Tonkin; e. *duvaucelii*—Malaya, Sumatra and lowlands of Borneo; f. *gigantorhina*—Nias I., west Sumatra; g. *tanamassae*—Batu Islands, W. Sumatra; h. *eximia**—mountains of Sarawak, North Borneo; i. *cyanea**—Mt. Kinabalu, north Borneo; j. *australis*—Java; k. *hebereri**—Bali.

20. *rubicapilla* (Gmelin)

Subspecies and range: a. *malabarica*—western coastal India from Goa through Travancore; b. *rubicapilla*—Ceylon.

21. *haemacephala* (P. L. S. Müller)

Subspecies and range: a. *confusa**¹—Bombay Presidency; b. *indica*—India except range of 'a', Baluchistan, the Northwest Frontier or the south-western Punjab, Nepal and Sikkim, Ceylon, Burma, Thailand, northern Malaya, Yunnan, and Indo-China except Tonkin; c. *delica*—Sumatra; d. *rosea*²—Java, Bali; e. *haemacephala*—Mindanao, Leyte, Samar, Mindoro, Calamianes (?), and Luzon, Philippine Is.; f. *intermedia*³—Cebu, Tablas, Romblon, Masbate, Guimaras and Negros, Philippine Is.

¹ M. Delacour, who has examined some of Koelz's specimens, assures me this is a valid race, much paler than *indica*.

² Failing any recent substantiation of *delica* and *rosea* overlapping in the Lampong district of south Sumatra, I prefer to keep these forms as subspecies.

³ I do not agree with M. Delacour (in litt.) that *intermedia* and *rosea* are inseparable. Eleven Philippine birds have culmen measurements of 21.5–23 mm. while seven Javan examples measure 16–18 mm. In addition, Philippine birds have more noticeable yellow bases to the feathers of the lower throat than do Javan specimens.

V. *Caloramphus* Lesson1. *fuliginosus* (Temminck)

Subspecies and range: a. *hayi*—southern Tenasserim, peninsular Thailand, Malaya and Sumatra; b. *fuliginosus*—western Borneo; c. *tertius**—north Borneo.

THE AFRICAN BARBETS

Gymnobucco like *Caloramphus* is a gregarious bird, dull-plumaged, with a sharply ridged culmen. Both genera have short, slightly rounded tails and similar wing formulae. The species grouped under *Gymnobucco*, however, have a tendency to naked heads and short, bristly tufts of feathers over the nares or about the angles of the bill and chin.

The next group of species is combined in *Pogoniulus*. These forms, as *leucotis* for example, have a tendency to a similarly ridged culmen, but also considerable variety in plumage color and texture. Chapin (1939: 488) separates *Buccanodon* from *Pogoniulus* on the basis of the latter having a wing measurement of less than 70 mm. and the first toe being less than half as long as the fourth. It seems apparent that these characters are used to maintain a generic name for its own sake. But if the species *duchaillui* is combined in *Buccanodon* with the species *anchietae* in which the size is roughly the same but the color pattern vastly different, it would seem unnecessary to separate similarly colored species in different genera on the basis of size alone.

Smilorhis was characterized by Shelley (*tom. cit.*: 14) as having "the wing rather pointed, the primaries exceeding the secondaries by more than the length of the culmen; on the latter a well-marked crest." Unfortunately the primary-secondary-culmen comparison, as so often happens in these cases, is not valid in all cases. Also other species assigned by Shelley to different genera (*i. e.*, *Barbatula* = *Pogoniulus*) have well-marked crests on the culmen.

Viridibucco Oberholser (Proc. U. S. Nat. Mus., 28: 865, 1905) has a smaller bill, but only in proportion to its smaller size. The naked space around the eye is reduced in the same way in *leucomystax* that it is in the larger species *olivaceum*. Otherwise there are no significant differences. The character of the yellow stripe used by Chapin (*tom. cit.*: 488) is not valid in the case of the species *simplex*. Oberholser's remarks in his discussion of the validity of *Barbatula*, *Smilorhis* etc. (*tom. cit.*: 865-866) are worth reading today in that they indicate very well the transitional position of *duchaillui* between the species *anchietae* (formerly in *Stactolaema*), *leucotis* (formerly in *Smilorhis*) and

scolopaceus, *pusillus*, etc. (in *Pogoniulus*). Oberholser uses *Xylobucco* for the last but Richmond (Proc. U. S. Nat. Mus., 35: 634, 1908) shows that *Pogoniulus* should replace it.

The name *Micropogonius* Roberts for the golden-rumped tinker bird, *Pogoniulus bilineatus*, has not been used by recent authors; i. e. Slater, Friedmann, Chapin.

I have combined several genera in *Lybius* on the basis of relationship. In this case it is simply a matter of taste as to whether to recognize such monotypic genera as *Pogonorhynchus* and *Erythrobucco* or not. I prefer not to recognize them as they are end products of a continuous cline of development for which there are connecting links. If the links were lacking as in the case of *Semnornis* then there would be no indication of relationship, but in this case it is present in the case of *bidentatus* which differs primarily only in degree. Comparison of the characters follows:

	<i>Chin bristles</i>	<i>Upper mandible</i>	<i>Lower mandible</i>	<i>Flank patches</i>
<i>bidentatus</i>	prominent	toothed	smooth	present
<i>E. rolleti</i>	tufted	toothed and lightly ridged	smooth but thickened	present
<i>P. dubius</i>	double tufts	toothed and ridged	thickened and sulcated	present

The plumage of these species is similar in color and pattern with only minor differences such as the color of the throat which varies from crimson to black, sometimes followed by a black breast band.

Of the genus *Tricholaema*, Chapin says (tom. cit.: 488): "chest feathers usually with long hair like tips; no red on head unless restricted to forehead and head never entirely white." All species of so-called *Tricholaema* have toothed upper mandibles as in the case of *Lybius*. In addition, *Lybius melanopterus* has hair-like tips to the chest feathers, *L. undatus* has red restricted to the forehead, and only one small group in *Lybius*, out of a number of species, has the head entirely white. Therefore, I fail to see how *Tricholaema* can be maintained.

Reichenow erected the genus *Trachylaemus* for the species *purpuratus* which has shorter crown feathers than *Trachyphonus vaillantii*, etc. The feathers of the former species are somewhat stiffened and bifurcate on the chin and throat and the upper parts are glossy black. However, I feel that these characters are not of generic value. Even the presence of bifurcate feathers in other non-passerine birds, as in some species of fruit pigeons (*Ptilinopus*), is not considered to be a generic character. The arrangement follows:

VI. *Gymnobucco* Bonaparte1. *bonapartei* Hartlaub

Subspecies and range: a. *bonapartei*—Cameroon and Belgian Congo to lower Ituri; b. *intermedius*—eastern Congo and western Uganda; c. *cinereiceps*—Uganda from Toro to Mt. Elgon.

2. *peli* Hartlaub

Subspecies and range: a. *peli*—Gold Coast, Cameroon to lower Congo valley; b. *sladeni*—Ituri district, Congo.

3. *calvus* (Lafresnaye)

Subspecies and range: a. *calvus*—Sierra Leone, Liberia to south Nigeria; b. *major*—Cameroon to Gaboon; c. *vernayi*—northern Angola.

VII. *Pogoniulus* Lafresnaye1. *leucotis* (Sundevall)

Subspecies and range: a. *leucotis*—Nyasaland, Zululand and Natal; b. *bocagei*—Angola; c. *leucogrammicum*—Tanganyika, Rufiji valley; d. *kilimensis*—east Africa.

2. *anchietae* (Bocage)

Subspecies and range: a. *katangae*¹—Lualaba valley, Belgian Congo to Serenje in Northern Rhodesia; b. *anchietae*—central Angola and southern Congo; c. *rex*—Loanda, northern Angola; d. *sowerbyi*—Angoniland and Mashonaland; e. *stresemanni*—southern end of Lake Tanganyika, Kitungulu; f. *whytii*—Nyasaland east and southeast of Lake Nyasa to Northern Rhodesia.

3. *olivaceum* (Shelley)

Subspecies and range: a. *olivaceum*—Kenya and Usambara and Uluguru Mts.; b. *woodwardi*—Zululand and Nchingidi, Tanganyika.

4. *duchaillui* (Cassin)

Subspecies and range: a. *duchaillui*—Liberia, Cameroon to upper Congo. b. *gabriellae*—French Congo, Stanley Pool and Mayombe.

5. *pusillus* (Dumont)

Subspecies and range: a. *pusillus* eastern Cape Province to Zululand; b. *affinis*—southern Somaliland west to Lake Victoria Nyanza, south

¹ The occurrence of *Buccanodon sowerbyi buttoni* White (Bull. Brit. Orn. Club, 65: 18, 1945) at Ndola, Northern Rhodesia within the range of *katangae* deserves careful checking. The distribution of this species as a whole is not clear.

to Dar es Salaam; c. *uropygialis*—Eritrea and Abyssinia, parts of Somaliland.

6. *chrysoconus* (Temminck)

Subspecies and range: a. *schubotzi*—southern Sahara to Lake Chad; b. *chrysoconus*—Senegal to Gold Coast and Togoland; c. *centralis*—Uganda; d. *zedlizzi*—Egyptian Sudan; e. *xanthostictus*—central and southern Ethiopia; f. *rhodesiae*—northern Nyasaland, southeastern Belgian Congo; g. *extoni*—southern Angola, southeast Nyasaland, Bechuanaland and western Transvaal.

7. *bilineatus* (Sundevall)

Subspecies and range: a. *togoensis*—lower Nigeria, Togoland to Gold Coast, Senegal; b. *leucolaima*—central Angola north to Bozum; c. *poensis*—Fernando Po I.; d. *nyansae*—Uganda from east Congo border to southern end of Lake Tanganyika;¹ e. *bilineatus*—Natal, Zululand, eastern Transvaal, north through eastern Rhodesia and Nyasaland to southwest Tanganyika; f. *jacksoni*—Mau Plateau to Nairobi, Mt. Elgon; g. *fischeri*—Mombasa to Mikindini; h. *conciliator*—Uluguru Mts., Tanganyika; i. *alius*—Kenya highlands east of Rift valley.

8. *subsulphureus* (Fraser)

Subspecies and range: a. *chrysopygus*—Gold Coast and Liberia; b. *flavimentum*—eastern Sierra Leone to Gaboon and lower Congo; c. *subsulphureus* Fernando Po I.

9. *erythronotus* (Cuvier)

Range: Senegal to Portuguese Congo east to Ruwenzori and the Uele district.

10. *coryphaeus* (Reichenow)

Subspecies and range: a. *coryphaeus*—highlands of Cameroon; b. *hildamariae*—highlands of eastern Congo; c. *angolensis*—highlands of Angola.

11. *simplex* Fischer and Reichenow

Subspecies and range: a. *simplex*—coastal region of Tanganyika, Zanzibar; b. *leucomystax*—Kenya and Tanganyika from interior to mountains west of Lake Nyasa.

12. *scolopaceus* (Bonaparte)

Subspecies and range: a. *scolopaceus*—Sierra Leone and Liberia to Calabar; b. *stellatus*—Fernando Po I.; c. *flavisquamatus*—Cameroon

¹ Includes *mfumbiri*.

and Gaboon; d. *flavior*¹—northern Angola; e. *aloysii*—Uganda east to Naivasha, Kenya.

VIII. *Lybius* Hermann

1. *melanocephalus* (Cretzschmar)

Subspecies and range: a. *melanocephalus*—Bogosland and Ethiopia to Addis Ababa, east to Harrar; b. *stigmatothorax*—southern Ethiopia, Lakes Rudolf and Stephanie areas south to Dodoma, Tanganyika; c. *blandi*—central and eastern Somaliland from the Goolis Mts. to Obbia; d. *flavibuccale*—Wembaerae Steppes, Tanganyika.

2. *lacrymosum* (Cabani)

Subspecies and range: a. *lacrymosum*—northern Uganda, Kenya to northern Tanganyika; b. *radcliffei*—Uganda from Lake Albert southeast to Tororo and south to Lake Victoria Nyanza, adjacent parts of Tanganyika; c. *ruahae*—inland parts of southeast Tanganyika.

3. *leucomelas* (Boddaert)

Subspecies and range: a. *leucomelas*—Angola and Zambesi to Cape Province in the west; b. *namaqua**—Little Namaqualand; c. *centralis**—Transvaal; d. *nkatiensis**—northern Bechuanaland.

4. *diadematum* (Heuglin)

Subspecies and range: a. *diadematum*—upper White Nile and southern Ethiopia to northern Somaliland; b. *mustum**—northeast Uganda east through Kenya as far south as Mt. Kenya; c. *massaicum*—southern Kenya to northern Tanganyika; d. *frontatum**—Nyasaland to Angola.

5. *hirsutum* (Swainson)

Subspecies and range: a. *hirsutum*—Liberia and Gold Coast; b. *hybridum*—southern Nigeria; c. *chapini*—upper Uele, Belgian Congo; c. *ansorgii*—Uganda; d. *flavipunctatum*—Cameroon to lower Congo; e. *angolense**—northern Angola.

6. *undatus* (Rüppell)

Subspecies and range: a. *undatus*—Ethiopia; b. *gardullensis**—lake region of southern Shoa and Gofa of middle Omo region; c. *leucogenys*—western Ethiopia south to the Gofa country; d. *salvadorii*—Harrar Mts. eastern Ethiopia; e. *thiogaster**—northern Ethiopia and Eritrea.

¹ New name for *angolensis* Bannerman (B. B. O. C. 53: 184, 1933) which is preoccupied by *P. c. angolensis* Boulton (Ann. Carn. Mus. 21, no. 1: 46, 1931).

7. *vieilloti* (Leach)

Subspecies and range: a. *vieilloti*—Bogosland and Egyptian Sudan; b. *rubescens*—Senegal to Cameroon, inland to northern Nigeria.

8. *guifsobalito* Hermann

Subspecies and range: a. *guifsobalito*—Bogosland, southwest Eritrea, Ethiopia (except the southeast) and the Blue Nile district of the Sudan; b. *ugandae**—northeastern Belgian Congo east through Uganda.

9. *melanopterus* (Peters)

Range: Juba River, Somaliland south to eastern Kenya and Tanganyika to Nyasaland and Mozambique.

10. *torquatus* (Dumont)

Subspecies and range: a. *torquatus*—Angola, Zambesi valley south to Cape Province; b. *conicus*—Congo valley south to Katanga and Njombe; c. *irroratus*—east Africa from Lamu to Ugogo in Tanganyika.

11. *leucocephalus* (Defilippi)

Subspecies and range: a. *leucocephalus*—upper White Nile from Lado west to Bahr el Ghazal south to Mt. Elgon and Uganda; b. *adamamae*—Shari river to Adamawa in northeastern Cameroon and northern Nigeria; c. *albicaudus*—Kenya and Tanganyika from Nairobi to Ugogo; d. *lynesi**—Iringa, Tanganyika; e. *senex*—southern Kenya from Nairobi to Kitui; f. *leucogaster**—Angola.

12. *levaillantii* (Vieillot)

Subspecies and range: a. *levaillantii*—lower Congo and northern Angola; b. *intercedens*—Manjanga, Congo; c. *macclounii*—northern Lake Nyasa west through Northern Rhodesia to Katanga district, Congo.

13. *bidentatus* (Shaw)

Subspecies and range: a. *bidentatus*—Sierra Leone to Gold Coast; b. *aequatorialis*—French and Belgian Congo, Uganda, Ruanda and Tanganyika; c. *aethiops*—Sudan and Ethiopia except the Hawash Basin.

14. *rolleti** (Defilippi)

Range: Upper White Nile west to Shari valley, French Congo.

15. *dubius* (Gmelin)

Range: Senegal, Sierra Leone and Portuguese Guiana east through inland Gold Coast to northern Nigeria.

IX. *Trachyphonus* Ranzani1. *vaillantii* Ranzani

Subspecies and ranges: a. *suahelicus*—East Africa from the Pangani river to the Zambesi; b. *vaillantii*—southern Angola and Zambesi south to Natal and Zululand.

2. *erythrocephalus* Cabanis

Subspecies and range: a. *erythrocephalus*—northern Tanganyika and Kilimanjaro region; b. *versicolor*—western Kenya and eastern Uganda; c. *jacksoni**—central Kenya and southern Ethiopia; d. *gallarum**—east central Ethiopia; e. *shelleyi*—eastern Ethiopia, extreme western Italian Somaliland and central British Somaliland.

3. *margaritatus* (Cretzschmar)

Subspecies and range: a. *margaritatus*—Egyptian Sudan from Suakim and Khartoum south through Ethiopia, Eritrea, Bogosland, west to Lake Chad, northern Nigeria and Asben in the southern Sahara; b. *somalicus*—northern Somaliland and Gallaland.

4. *darnaudii* (Prévost and Des Murs)

Subspecies and range: a. *darnaudii*—Kordofan, upper White Nile and Shoa to the Rift valley in Kenya; b. *usambiro*—southern Kenya to the country south and southwest of Lake Victoria, Tanganyika; c. *bohmi**—southern Italian Somaliland, eastern Kenya to northeast Tanganyika; d. *emini*—Tanganyika from Ugogo south to northern Lake Nyasa.

5. *purpuratus* Verreaux

Subspecies and range: a. *purpuratus*—Cameroon to Angola east Yambuya; b. *elgonensis*—Uganda to Mt. Elgon and the Mau plateau in Kenya, and the upper Uele district; c. *goffinii*—Sierra Leone and Liberia to the Gold Coast; d. *togoensis*—Togoland and Ifon, southern Nigeria, Lagos.

CONCLUSION

The barbet family is considered to consist of a closely knit family of nine genera and sixty-six species. Within the family there are a limited number of characters such as bill form and plumage color patterns which reappear throughout in a variety of combinations. Thus with a lack of any great number of morphological characters it becomes difficult to set up more than a very few satisfactory generic categories. On the other hand, the restricted and overlapping ranges

of the members of the family coupled with the lack of variety in plumage pattern necessitates the maintenance of a large number of species. Nor can these species, many of which are obviously closely related, even be combined in larger groups such as superspecies, due to the degree of geographical overlapping which is present. The barbets thus seem to represent a condition of dispersal and speciation in which the development of physiological barriers to inbreeding has not been paralleled by an equal development of a variety of morphological characters.

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SOME NEW RECORDS FROM NEWFOUNDLAND

BY HAROLD S. PETERS AND THOMAS D. BURLEIGH

THE Fish and Wildlife Service, United States Department of the Interior, and the Department of Natural Resources of Newfoundland have been conducting a coöperative study of the bird life of Newfoundland for several years. Intensive field work on this project was carried on by the authors from May 31 to July 3, 1942, and from June 6 to July 14, 1943. The coöperating agencies intend to continue field investigations by annual trips into different parts of the country. It is hoped that a comprehensive work on the birds of Newfoundland will eventually result from our studies. A number of new records have been obtained during the past two years and are presented in this preliminary paper. All of these are additions to the 1931 A. O. U. Check-List.

GREEN-WINGED TEAL, *Anas carolinensis* Gmelin.—Breeds fairly commonly in the interior. We have recorded it from Chapel Island, Pistolet Bay, Birchy Lake, Colinet, and Hawkes Bay. A female with six young was seen July 13, 1943, at Searston.

PIPING PLOVER, *Charadrius melodus* Ord.—A breeding record was obtained July 10, 1943, at the mouth of Little Codroy River when we collected a downy young. Two pairs were evidently nesting there. On July 13, 1943, at the mouth of Grand Codroy River, we found five or six pairs. Bent (U. S. Nat. Mus., Bull. 146: 244, 1929) says that it probably breeds at Stephenville Crossing and St. George's Bay, about 50 or 60 miles north of where we found it.

SEMIPALMATED PLOVER, *Charadrius hiaticula semipalmatus* Bonaparte.—We believe that the first positive breeding record was procured July 10, 1943, when we collected a downy young at the mouth of Little Codroy River. Eight or ten pairs were probably breeding there, while three pairs were found at the mouth of Grand Codroy River on July 13, 1943. Adults were seen also at Cooks Harbour on June 25, 1943, and at White Island on June 30, 1943. These may both represent additional nesting localities since Bent (*tom. cit.*: 225) says that it breeds to the Strait of Belle Isle although he cites no authority.

HUDSONIAN CURLEW, *Numenius phaeopus hudsonicus* Latham.—On June 27, 1943, at Boisee Island, in Pistolet Bay, in extreme northern Newfoundland, we collected a female with enlarged ovaries, which indicated that she had recently laid eggs or was about to do so. During our efforts to collect her she persistently returned to this island. This seems to be the first specimen from Newfoundland and indicates

possible breeding. Bent (*tom. cit.*: 124) says that Macoun and Hagerup list it from Newfoundland without giving the evidence.

NORTHERN PHALAROPE, *Lobipes lobatus* (Linnaeus).—We shot three birds from eleven in several small groups at the mouth of Pistolet Bay, Strait of Belle Isle, on June 25, 1943. One was a subadult male and the others were a male and female in breeding condition. This indicates a possible breeding record and these are evidently the first specimens from the country.

COMMON TERN, *Sterna hirundo hirundo* Linnaeus.—We can find no previous records of this species nesting in Newfoundland, although Ridgway (U. S. Nat. Mus., Bull. 50, pt. 8: 494, 1919) says it breeds in the country, probably basing his belief on a specimen in the U. S. National Museum collected by William Palmer on Penguin Island, July 24, 1887. Arnold (Auk, 29: 75, 1912) reported a small colony in Bay of Islands on June 7, 1911, but they were apparently not yet building nests. We collected an adult from each of the following nesting colonies: Notre Dame Bay, Cape St. Marys, Canada Bay (two colonies), Sacred Islands, Pistolet Bay, Hare Bay, Coachman's Cove, mouth of Little Codroy River, and mouth of Grand Codroy River, and all proved to be of this species.

SHORT-EARED OWL, *Asio flammeus flammeus* (Pontoppidan).—A partly grown young male was taken at Whitbourne, on the Avalon Peninsula, June 28, 1942. This seems to be the first breeding record although the species evidently nests locally in suitable places on the island. We have seen adults at Quirpon, Schooner Island, Boisee Island (Pistolet Bay), and on Great Cormorandier Island, all of which localities are near the northern tip of the country.

BANK SWALLOW, *Riparia riparia riparia* (Linnaeus).—We found this species present in several localities in extreme southwestern Newfoundland early in June and in mid-July, 1943, so it undoubtedly nests locally. A male was taken at the mouth of Little Codroy River on July 10, 1943. Arnold (*tom. cit.*: 78) reported several pairs starting to nest in sand pits at St. George's Bay, June 10, 1911.

BARN SWALLOW, *Hirundo rustica erythrogaster* Boddaert.—Undoubtedly nests locally in extreme southwestern Newfoundland where we found it in several localities. We collected a male at Tompkins on June 7, 1943, and a female with a distinct brood patch at the mouth of Grand Codroy River on July 13, 1943.

NEWFOUNDLAND VEERY, *Hylocichla fuscescens fuliginosa* Howe.—We have taken seven specimens which all seem typical of Howe's *fuliginosa* (Auk, 17: 270-271, 1900). We believe this to be a perfectly valid race. Our birds are darker than typical *fuscescens* and more rus-

set or reddish brown on the back than *salicicola*. Specimens were collected as follows: male, South Brook, June 5, 1942; female, Tompkins, June 9, 1943; female, Tompkins, July 9, 1943; male, Doyles, July 10, 1943; male, Tompkins, July 12, 1943; and two females, Tompkins, July 14, 1943.

EASTERN GOLDEN-CROWNED KINGLET, *Regulus satrapa satrapa* Lichtenstein.—This species has not been recorded from the country before, but we found it present locally in suitable habitats. We observed it at Salmonier, Makinson's, Brigus, Placentia, Princeton, South Brook, Badger, and Tompkins. We collected a female at Princeton on June 23, 1942, a male at Makinson's on June 26, 1942, and a male at Tompkins on July 11, 1943.

CEDAR WAXWING, *Bombycilla cedrorum* Vieillot.—The first Newfoundland record was obtained at Searston (extreme southwestern Newfoundland) on July 13, 1943, when we took a male with enlarged testes. An accompanying bird (possibly the female) was observed.

STARLING, *Sturnus vulgaris vulgaris* Linnaeus.—First recorded when we shot a female with a distinct brood patch on June 9, 1943, at Tompkins, in extreme southwestern Newfoundland. We believe she may have raised a brood before being collected. Another adult was seen at the same time.

PHILADELPHIA VIREO, *Vireo philadelphicus* (Cassin).—We obtained the first record at Tompkins on July 12, 1943, when we collected a female with a distinct brood patch, indicating a nesting bird.

TENNESSEE WARBLER, *Vermivora peregrina* (Wilson).—A pair was secured at Lomond on June 3, 1942. In the Carnegie Museum there is a male taken at Curling on June 25, 1920. A nest and four eggs were reported to have been taken at Gaff Topsail on June 25, 1913, by E. Arnold (Auk, 33: 8, 1916). Several sight records have been reported, but these seem to be the only specimens.

MYRTLE WARBLER, *Dendroica coronata coronata* (Linnaeus).—Recorded from the Avalon Peninsula in 1939 by Aldrich and Nutt (Sci. Publ. Cleveland Mus. Nat. Hist., 4: 35) and by Brooks (Auk: 53, 344, 1936). It has been recorded from the interior of the country by Arnold (*tom. cit.*: 78); Noble (Bull. Mus. Comp. Zoöl., 62: 561, 1919); and Rooke (Ibis, 13th ser., 5: 856-879, 1935). We have found it present locally in many places throughout the country: Tompkins, Lomond, South Brook, Badger, Grand Falls, Gambo, Terra Nova, Clarenville, Princeton, Brigus, St. Johns, Lewisporte, Thwart Island, Jackson's Arm, and Hare Bay. Specimens were secured at Deer Lake, June 3, 1942; Badger, June 8, 1942; Gambo, June 19, 1942; Claren-

ville, June 21, 1942; Makinson's, June 28, 1942; Tompkins, June 8, 1943; and Hare Bay, June 21, 1943.

EASTERN CHIPPING SPARROW, *Spizella passerina passerina* (Bechstein).—We found this species locally common and undoubtedly nesting in extreme southwestern Newfoundland during June and July, 1943. We collected a male at Tompkins on June 7, 1943. One was seen at St. Anthony (in northern Newfoundland) on June 22, 1943. Arnold (*tom. cit.*: 77) and Griscom (*Ibis*, 12th ser., 2: 656-684, 1926) found it at Bay of Islands.

WESTERN SWAMP SPARROW, *Melospiza georgiana ericrypta* Oberholser.—The Swamp Sparrow is generally distributed throughout the country. We collected 12 specimens: female, Badger, June 8, 1942; male, Badger, June 9, 1942; male, Gaff Topsail, June 12, 1942; female, Harbour Deep, June 14, 1943; male, Roddickton, June 15, 1943; male, Hare Bay, June 18, 1943; female, Hare Bay, June 21, 1943; male, Quirpon, June 23, 1943; male, Quirpon, June 24, 1943; male, Pistolet Bay, June 27, 1943; male, Tompkins, July 8, 1943; and a female, Searston, July 13, 1943. We found all of these to be the newly described (*Bird Life of Louisiana*: 675, 1938) *ericrypta*, another so-called western form now present in Newfoundland. Perhaps many races previously designated as "western" may in reality be "northern." Aldrich and Nutt (*tom. cit.*: 39) believed their six specimens to be intermediate between *georgiana* and *ericrypta*, but our larger series show the breeding Swamp Sparrow of Newfoundland to be *ericrypta*.

EASTERN SONG SPARROW, *Melospiza melodia melodia* (Wilson).—We took two males at Tompkins, June 8, 1943, a male at Codroy, July 9, 1943, and a male at Searston, July 13, 1943—all in breeding condition. We heard singing males in at least fourteen different localities during June and July, 1943, but all within a distance of approximately 25 miles. Several sight records have been published but no specimens seem to have been taken previously. A banded bird (36-64900) was found at Hants Harbour, Trinity Bay, August 18, 1941 (Cooke, *Bird-Banding*, 14: 74, 1943). This bird was originally banded at Randolph, Massachusetts, July 23, 1937, by Mrs. Ruth J. Wright. It is a most unusual record.

Fish and Wildlife Service

U. S. Department of the Interior
Charleston, South Carolina, and
Baton Rouge, Louisiana

THE BREEDING GOLDEN PLOVER OF ALASKA

BY BOARDMAN CONOVER

IN identifying a male Golden Plover taken with two half-grown young on the Bering Sea coast of Alaska, it was discovered that these specimens were typical of the American rather than the Asiatic race. As this is completely at variance with the breeding ranges of the two forms as given by the latest authorities, an investigation was undertaken to ascertain as far as possible the true facts as to the nesting grounds of the two races found in this territory. Since the number of Alaskan specimens in the Chicago Natural History Museum was insufficient, others were borrowed from leading museums. For the loan of this material I am indebted to H. W. Brandt of Cleveland; the California Academy of Sciences, San Francisco; the Chicago Academy of Sciences; the Colorado Museum of Natural History, Denver; the Museum of Comparative Zoölogy, Cambridge; the Fish and Wildlife Service and the United States National Museum, Washington; and the Museum of Vertebrate Zoölogy, Berkeley.

Only one specimen (from Collinson Point) was available from the Arctic coast east of the vicinity of Barrow and only four from the interior of Alaska. This territory, however, has always been assumed to be the breeding ground of the American form and this is borne out by the examination of the limited material available. It is true that Dixon (1938, p. 66) has identified the breeding birds of McKinley National Park as *fulva*, but an examination of two spring adults collected by him leaves little doubt that he was mistaken. These specimens are in full breeding dress, so identification can be made only by size, but both are large birds; the wing of the male measures 185 mm. and that of the female 187. Two others taken in the interior, a male and female from Rampart House and Fairbanks, have wing lengths of 179 and 187 mm., respectively.

From the vicinity of Barrow (Chipp River, Meade River) south along the northwest and west coasts of Alaska to the Alaska Peninsula, one hundred and sixty-nine adults, one hundred and twenty-one immature and twenty-two downy examples of Golden Plover were examined. The picture these specimens draw of the ranges in Alaska of the two forms *Pluvialis dominica dominica* and *Pluvialis dominica fulva* is probably better shown in the form of a table than by any other means. Attention should be called to the fact that under the heading *Downy* in this table is included all juveniles of such an age that there could be no doubt as to their having been hatched at the locality where they were collected.

*P. d. dominica**P. d. fulva*

North of Bering Strait

	Adult	Immature	Downy	Adult	Immature	Downy
Collinson Point	1					
Barrow and vicinity	67	8	14		5	
Wainwright and vicinity	11	38	1	3		2
Cape Lisburne	2					
Tigara, Point Hope			3			
Cape Blossom, Kotzebue Sound	4					
Kotzebue Sound				1		

South of Bering Strait

Wales				14		
Port Clarence	2				1	
Kruzgamedpa					2	
Teller, Port Townsend				1		
St. Lawrence Island				1	4	
Nome	2	2		23	19	
Port Safety					2	
Golovin Bay	1					
St. Michael	6	1		9	22	1
Askinuk Mts., Igiak Bay	1		2		1	
Hooper Bay	1				5	
Nelson Island	1					
Nunivak Island	4	1	2	7	8	2
Bethel					3	
Nushagak					1	

It will be noted immediately that there is a rather sharp difference in the relative numbers of each race found north and south of Bering Strait. North of that point the American form predominates, with the Asiatic appearing only as a straggler. From Wales south, however, the opposite prevails, but with this difference, that the typical race *dominica* instead of being simply a straggler constitutes about twenty-five per cent of the adults.

The capture of the above plover (except those shown as downies) at the different localities listed is of course no proof of their having nested or been hatched there. Some undoubtedly were still on migration or perhaps wanderers after the breeding season. Many of the specimens, however, show proof of actual breeding activities at different localities, either from data recorded on their labels or because of their age. Such evidence of the actual breeding of each race is given below.

Pluvialis dominica dominica

BARROW AND VICINITY.—Twelve downies, from at least four different broods, taken between July 23 and August 1; two two-thirds-

grown young collected August 7; twenty-four adults marked as having been taken with sets of eggs (in many cases there may have been duplication, with the inclusion of both parents) between the dates of June 14 and July 4; one adult taken with young July 23.

WAINWRIGHT.—A two-thirds-grown young collected August 7.

TIGARA, POINT HOPE.—An immature taken August 19 fully fledged but still slightly downy about bill. It may have been hatched elsewhere.

ASKINUK RANGE, IGIAK BAY (BETWEEN CAPE ROMANZOF AND POINT DALL, BERING SEA).—Two half-grown young and the male parent taken July 16. All three show the pale brownish gray breast coloration of typical *dominica* and the adult has a wing measurement of 181 mm.

NUNIVAK ISLAND.—Two half-grown young with the coloration of the under parts as in the American race, taken July 17. Of three adults taken on the same day by the same collector, C. G. Harrold, two males, by coloration and measurements, are typical *dominica*; the third, a female, by the same criteria, is *fulva*. Mr. Harrold, in his field notes, does not state whether any of these adults was the parent of the young, but at a later date, August 6, writes that he has noted that in nearly all cases the male is more concerned over the approach of an enemy than is the female. This same fact was noted by myself when collecting the two young and the adult male mentioned as having been taken at Igiak Bay.

Swarth (1934, p. 27), in a paper on the birds collected by Harrold on Nunivak Island, has identified all the above specimens as *fulva*. The two adult males referred to, however, besides having large wings measuring 181 and 184 mm., are far enough into the postnuptial molt to show that the coloration of the under parts would be the pale dusky brown color typical of the American race. The two half-grown young, also, have breasts of this color and not the yellow of *fulva*. In no way do any of these specimens or the adult male and two half-grown young from the Askinuk range on Igiak Bay indicate that they are hybrids, intermediates or aberrant specimens of the Asiatic race.

Pluvialis dominica fulva

WALES.—One adult male marked as having been taken with a set of eggs on July 3; wing 161 mm.

ANVIL MOUNTAIN, NOME.—A male, wing 165 mm., taken with a set of four eggs on June 21.

ST. MICHAEL'S.—Two juveniles, one taken August 14 (very yellow below) still downy on the throat and the back of the neck and with

the primaries not fully grown; the other taken August 15 with down at the base of the bill and with the outermost primary still showing a little of the sheath at the base.

ASKINUK MOUNTAINS, IGIAK BAY, BERING SEA (BETWEEN CAPE ROMANZOF AND POINT DALL).—A male with wing of 166 mm. collected with set of eggs, June 27.

BETHEL.—A male, wing 169 mm., collected with set of eggs, June 12.

NELSON ISLAND.—Two downy young taken July 9 and 24. The younger is newly hatched and an unmistakable downy of *fulva*. The other, with primaries about half an inch in length, has the down worn and faded, but appears to belong to the Asiatic race.

From the above it seems that the American race, *Pluvialis dominica dominica*, nests in suitable localities throughout the whole of the Alaskan mainland north of the Alaska Peninsula, including the Bering Sea coast and the closely adjacent islands, reaching the two latter regions probably by way of the interior river valleys. The Asiatic form, *Pluvialis dominica fulva*, on the other hand, appears to breed only along the actual coast of Bering Sea (again including the closely adjacent islands) where it evidently is the predominating race. Proof of the actual overlapping of the breeding grounds of the two forms is also given by these specimens, which brings up the question of just how closely they really are related.

I have been unable to discover any breeding records of Golden Plover from any of the other islands in Bering Sea except Nunivak and Nelson, but it would be surprising if the Asiatic race did not breed on St. Lawrence Island also.

As the characters distinguishing the two races do not seem to be too well known and are given only in very brief fashion by Ridgway, a more detailed account is presented here. These have been worked out not only from the Alaskan specimens, but also from a good series from Asia, Hawaii, the United States and Canada.

BREEDING PLUMAGE.—In this dress the only distinctive character seems to be one of size. Extremes of wing measurements of a series of adults from different localities are as follows:

	<i>Males</i>	<i>Females</i>
East coast North America.....	173-184 mm.	177-183
Interior North America.....	171-192	174-195
Hawaii.....	162-177	160-176
Asia.....	154-175	165-169

While the above measurements show some overlapping, it was found that, in general, the wings of *fulva* ran 172 mm. or less in the males

and 176 mm. or less in the females. Using these wing lengths (flat) as a maximum for the Asiatic race, it is believed that the error in identification would run less than ten per cent. Four out of forty adults from North America exclusive of Alaska have wing lengths under these measurements, while four out of forty-five adults and winter birds from Hawaii and Asia have longer wings. However, an adult male of *fulva* from Alaska does have a wing measurement of 183 mm. This bird was taken late enough in the season so that it could be identified by the coloration of the new winter plumage appearing on its chest.

Adults taken after the first part of July often have enough of the new winter plumage on the under parts to make identification possible by coloration alone. The first new feathers appear on the sides of the face, throat and upper chest. In *fulva* these are quite yellowish and contrast strongly with the black feathers of the breeding plumage, while in typical *dominica* they are pale brownish gray and much less noticeable.

IMMATURE PLUMAGE.—Compared with the Asiatic form, the American race has the upper parts much less yellowish, and this color usually has a lemon rather than a golden tone. However, specimens of typical *dominica* taken in Alaska, when the plumage is fresh and quite unworn, are yellower as a rule than those taken farther south in the United States. For this reason the northern birds may be misidentified as *fulva* if reliance is placed on the coloration of the dorsal surface alone.

It is in the coloration of the under sides where the greatest difference occurs. Typical *dominica* is pale dusky brown below, darkest on the lower foreneck and chest and sometimes with an indistinct yellowish wash on these parts and on the cheeks. *Fulva* on the other hand has the ground color much lighter about the belly and vent and is usually much yellower, with the strongest concentrations of this color on the chest, foreneck and cheeks. In other words, the American race has the general appearance of the under sides light brownish gray with the belly and vent practically as dark as the chest, while the Asiatic form has a lighter and generally much yellower appearance, with the belly in most cases distinctly whiter than the chest, but often with the feathers of the flanks tipped with dusky. Occasionally there is found an example of *fulva* approaching typical *dominica* in the coloration of the belly, but in these cases the specimen is much more profusely marked with golden yellow above.

Wing measurements in immatures seem to run somewhat smaller than in adults. Specimens of the American race usually measured

between 170 and 180 mm., and those of the Asiatic between 160 and 170.

WINTER PLUMAGE.—As pointed out by Alden Miller (1944, p. 130), in *fulva* the young of the year seem to have a more mottled belly than adults in winter plumage. However, examination of a series from Hawaii and Asia leads to the belief that this character does not hold good in birds taken later than about December. After that date, wear seems to remove the dusky tips of the belly feathers on the immatures, leaving them practically indistinguishable from the adults.

The few specimens of typical *dominica* available from its winter range are all unfortunately immatures taken not later than November. However, from the appearance of adults which are well into the fall molt, it seems that they differ from the birds of the year in the same way as *fulva*, *i. e.* in a whiter and less mottled belly.

DOWNY PLUMAGE.—Three specimens from Siberia are very different from a good series taken about Point Barrow and Churchill, Manitoba. The chicks of *fulva* differ as follows from those of *dominica*: (a) the upper parts are much more profusely spotted with yellow and are more golden (less greenish) in tone; (b) there is a very distinct yellow wash covering the broad white collar on the hindneck, the sides of the face, neck and chest, all of which is entirely lacking in chicks of *dominica*; (c) the two narrow white stripes down the sides of the back, usually very evident in the American race, are practically obsolete in the Asiatic form, probably being hidden under a yellow wash similar to that on the hindneck.

While the above distinctions hold good in the three Siberian downies examined, a newly hatched specimen from Nelson Island lacks much of the yellow wash on the chest although otherwise typical of *fulva*. A larger chick from the same locality, with somewhat faded down, shows no yellow on chest, sides of face, or back of neck, but has the upper parts golden rather than lemon in tone.

DOWNY SPECIMENS EXAMINED

Pluvialis dominica dominica.—17: ALASKA (Cape Simpson, 2; Barrow, 2; Chipp River, 8); MANITOBA (Churchill, 5).

Pluvialis dominica fulva.—5: SIBERIA (Kolyma Delta, 3); ALASKA (Nelson Island, 2).

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A NEW WREN FROM ARIZONA

BY HERBERT BRANDT

ARIZONA is an arid wonderland of plains, valleys and mountains. For the purposes of bird study, southeastern Arizona may be divided, chiefly by altitude and the climatic changes that this involves, into three major categories or life zones: the so-called 'Desert', comprising the Lower Austral Life Zone; the Foothills, or Upper Austral Life Zone; and the Highlands, that include the Transition and Canadian life zones.

During years previous to 1945 I had devoted four fruitful expeditions afield to investigating the breeding habits of the birds on the desert and in the foothills, and had touched the highlands just enough to whet my appetite for more experiences there. Meanwhile, Major Allan Brooks had painted for me several superb pictures of the sensationally beautiful birds of Apacheland, so I was anxious to finish the field work for my forthcoming book on Arizona bird life.

Due to the mystifying complexities of the floral and faunal life in this strange region of much avian research, I had long since learned that I should need considerable help if I were to make my report an acceptable contribution to the knowledge of Arizona birds. With this in view, I planned to make the 1945 Huachuca Highland Expedition an exceptionally notable one from the standpoint of helpful personnel.

In accordance therewith, I invited three of my ornithological friends to assist me in my mountaineering bird studies: Dr. Harry C. Oberholser, so well known and loved by the bird fraternity; Nelson K. Carpenter, outstanding California oölogist, who had spent several seasons afield in southern Arizona; and Lyndon L. Hargrave, for ten years Assistant Director of the Museum of Northern Arizona.

All three of these capable men kindly agreed to become members of an expedition into the Huachuca Mountains, and we enjoyed together, in that wonderful bird-classic highland, a most delightful and interesting sojourn.

Because of the ruggedness of the upended terrain, and the fact that

our work was to be principally above 7,000 feet, we required the use of a string of horses, both for riding and for packing water and supplies, especially to our camps along the skyline. We were pleased to obtain the services of three young frontier Arizonians, who handled our horses and packing and assisted us generally.

We were especially fortunate when we secured permission from Mr. and Mrs. L. H. Seeman, owners of the Tungsten Reef Mine, situated on the upper flanks of Carr Peak, to occupy certain of their cabins as our headquarters and laboratory. This tungsten property is at an elevation of 7,200 feet, and at the top of a steep, switchback road, which climbs dizzily upward, the highest, by far, of any similar trail in these rugged mountains.

After we arrived, the Seemans devoted most of their time to our welfare, so actually we had a party of nine persons for the month of June, all engaged in quest of bird secrets. The adventures we enjoyed in those glorious forested highlands, and the various nature problems discussed by the veteran members of our party, made the whole affair, for me, a most helpful and inspiring experience.

At an elevation of some 7,200 feet, in one of the main defiles of Major John Healy's Carr Canyon Ranch, in the Huachuca Mountains, on June 6, 1945, I detected a feathered flash leaving the opposite side of a large ash when I 'squeaked' and scraped its rough bark. This tree was growing at the stream-bed, so I climbed the adjacent abrupt slope, to a level of the upper half of the tree.

Before long the bird appeared and nervously entered a natural cavity, which proved to be its nest, but quickly departed. The next time it returned, I was able to obtain a good view of it with 8-power glasses, and, although it had the general behavior and appearance of a House Wren, yet there was a decided buff stripe above the eye.

Meanwhile a wren was singing vigorously close by, a song similar to that of the House Wren, but my ear warned me that it was different. Working with the late Prentiss Baldwin over the years, I had become familiar with his much-studied bird, and little dreamed that high in the Huachucas I would have use for that very knowledge.

These observations I called to the attention of Doctor Oberholser, who by now had joined me, and it was decided to investigate further the following day, because the equipment we had with us was insufficient to get at the nest which was in the main trunk, 16 feet from the ground. We agreed, however, that we had found something exciting!

The next morning, June 7, Nelson Carpenter, with boldness and extreme difficulty, chopped through the 10-inch living trunk to the nest, and removed five incubated eggs, which appeared about a third smaller

and more sparingly marked than those of the House Wren. Meanwhile, Lyndon Hargrave skillfully collected both shy parents, and we realized that we had an avian find. Doctor Oberholser at once pronounced the birds Cahoon's Wrens (*Troglodytes brunneicollis cahooni*), a most remarkable memory feat, as he had not studied this Mexican species in nearly 40 years.

A second nest of this bird I discovered on June 8, several miles away in another canyon of the range, also at an elevation of 7,200 feet. Its presence was suspected as the result of a male's singing, and later a bird was seen entering a natural cavity in a tall, upright branch of an ash, 35 feet up, which proved to be in a position too unsafe to climb. As a consequence we did not inspect this 'wrenery,' although we quickly learned that the parents were then feeding young, and later we collected the male.

Our experiences with this wren soon became so varied that Lyndon Hargrave assigned unto himself the task of observing it intensively. What we thought at first to be an isolated Arizona pair of this bird proved wrong, and as we became familiar with its habits, and could detect the differences between it and the Western House Wren, we found it more common than we had realized.

All nests discovered were situated at an elevation of between 7,000 and 7,300 feet, in well-wooded canyon bottoms of the Transition Life Zone, and were in a region where the Western House Wren was absent, although higher up the latter is not uncommon. Below 6,000 feet, Baird's Wren (*Thryomanes bewickii crenophilus*) is often encountered.

It seems to have been a long, long time since a distinct species of breeding bird, new to North America, together with its unknown nest, eggs, and young, have all been linked in one thrilling discovery, so one may well picture the excitement created among the four old-time field men, finally to have realized, and shared equally, in an ornithologist's daydream.

This wren is not only a species of bird new to North America, but also an undescribed subspecies, which may be called

***Troglodytes brunneicollis vorhiesi*, subsp. nov.—APACHE WREN**

TYPE.—Adult male, No. 4130, collection of Herbert Brandt; Pat Scott Canyon, altitude 7,200 feet, Huachuca Mountains, Cochise County, Arizona, June 23, 1945; Lyndon L. Hargrave, collector.

SUBSPECIFIC CHARACTERS.—Similar to *Troglodytes brunneicollis cahooni* Brewster, from the plateau of northwestern México in the states of Sonora and Chihuahua, but duller and more grayish (less buffy) particularly on the under parts.

MEASUREMENTS.—Four adult males:—Length (skins), 104–111 mm. (107); wing, 49–52 (50); tail, 43–44 (43.2); exposed culmen, 12–13 (12.5); tarsus, 16.5–17 (16.7); middle toe, 11.5–12.4 (12.1).

Three adult females:—Length (skins), 103–105 mm. (104); wing, 50 (50); tail, 41–42 (41.3); exposed culmen, 11–13 (12); tarsus, 16–17 (16.5); middle toe, 11–12 (11.3).

GEOGRAPHIC DISTRIBUTION.—The Huachuca and Santa Rita mountains of Arizona and southward for an undetermined distance.

REMARKS.—I take this opportunity of inscribing this new wren to Dr. Charles T. Vorhies, whose work on the zoology of Arizona is well known.

In conclusion I wish to express my thanks to the Museum of Comparative Zoölogy, Cambridge, and the U. S. National Museum, Washington, for the generous loan of specimens used for comparison in this study.

*The Bird Research Foundation
Cleveland, Ohio*

A REVIEW OF THE FORMS OF THE BROWN PELICAN

BY ALEXANDER WETMORE

UNDERSTANDING of the races to be recognized among the Brown Pelicans has been developing gradually since the tenth edition of Linnaeus in 1758, where all pelicans of the entire world, white or brown, were listed under the name *Pelecanus onocrotalus*. In 1766 Linnaeus formally separated the Brown Pelican as distinct under the name *occidentalis*, basing this on Sloane and Ray. Gmelin in 1789 included the Peruvian Pelican, known now under the name *thagus* of Molina, and Ridgway in 1884 described the bird of the west coast of the United States under the name *californicus*. Other early names were used for these birds but their application was confused and uncertain.

When W. L. Abbott began sending birds from Hispaniola more than 25 years ago, Charles W. Richmond and I recognized that the Brown Pelicans of that island were smaller than those of the southeastern United States and therefore different, and prepared some notes on the subject, but for various reasons these were never published. Peters ('Check-list of Birds of the World,' 1: 81, 1931) made this separation, listing in all four races, *viz.*, *occidentalis*, *carolinensis*, *californicus* and *thagus*. Murphy ('Oceanic Birds of South America,' 2: 808–810, 1936) revised the ranges of these in more detail, discussed the characters, and indicated that the Galápagos population, which had earlier been attributed to *californicus* and to *occidentalis*, was probably distinct.

In the studies of this subject that I now present I have examined and measured the Brown Pelicans in the National Museum, the Academy of Natural Sciences, the American Museum of Natural History, and the Museum of Comparative Zoölogy. Dr. A. van Rossem has given me measurements and notes on the specimens in the Dickey collection and in the Los Angeles Museum, F. Carlos Lehmann V., those in the Instituto de Ciencias Naturales in Bogotá, and Robert T. Moore, those in the Moore collection. I have to thank Mrs. Hermon Dunlap Smith for measuring the considerable series in the Chicago Natural History Museum. In addition to those that have been measured I have examined many more in which the sex was not marked and which therefore were not used in the measurement tables.

While the data thus available are extensive they are not final as regards many points in distribution, particularly for the Caribbean area and for the west coast of Central America and México. And while I have included the huge Peruvian Pelican as a race of *occidentalis*, I am not wholly certain that it should not be called a distinct species.

In the following account, the localities indicate those from which specimens were seen, no attempt being made to list the breeding colonies.

PELECANUS OCCIDENTALIS OCCIDENTALIS Linnaeus

Pelecanus occidentalis LINNAEUS, Syst. Nat., ed. 12, 1: 215, 1766
(Jamaica).

Smallest of the races; generally similar in color to *carolinensis*, but in breeding dress averaging darker on the under surface; in non-breeding stage usually, but not always, darker above.

Males (16 specimens): wing, 461-496 mm. (478); tail, 114-130 (126); culmen, 255-306 (288); tarsus, 68-78 (71.2).

Females (14 specimens): wing, 448-486 mm. (462); tail, 114-128 (124, average of 12); culmen, 251-286 (261); tarsus, 58-77.2 (67.1).

Breeding in Jamaica, Haiti (Grande Cayemite Island, Gonave Island, Gran Boucan), the Dominican Republic (Caño Hondo and Cayo Levantado in Samaná Bay), and Puerto Rico, (Aguadilla, Añasco, Mayagüez, Mameyes), and through the Lesser Antilles to St. Eustatius, Antigua and Guadeloupe, probably farther to the Grenadines (Catholic Island); Aruba, probably Curaçao, and Bonaire; apparently wandering to the Bahamas (Rolle Cay, Great Inagua Island), the Caribbean coast of Mexico (Contoy Island and Puerto Morelos, Quintana Roo), and Florida (Pensacola).

The breeding range of the typical form in general is in the central

and southern sections of the West Indies. I have seen only one specimen from Jamaica, a male in breeding dress, without date or definite locality, in the American Museum of Natural History, one of the smallest specimens examined. Many years ago I recognized the small size of the bird of Hispaniola from bones found in archeological sites by W. L. Abbott, with the result that we received several skins from that island. Beyond Puerto Rico I have actually seen specimens from St. Eustatius, Antigua and Guadeloupe, with one of somewhat questionable determination, as it is intermediate in size, from Catholic Rock, near Catholic Island, in the Grenadines. The status of the breeding pelicans from Guadeloupe southward remains to be definitely settled, since I have handled birds some of which are assigned to this form and some to *carolinensis* from Guadeloupe and the Grenadines. Three from Aruba are typical of this small race, being two males taken June 25, 1892, one in breeding dress and one with white head and neck, and a female, shot April 28, 1908, which is immature. These seem sufficient to establish this area as an outlying colony of true *occidentalis*. From present knowledge this seems to be an isolated group located far to the south of the main body of its relatives. It is probable that the same form inhabits Curaçao, as the pelicans that I have seen there in life have seemed small, and also Bonaire.

These birds appear to wander to some extent when not nesting. There is a specimen in the U. S. National Museum taken in March, 1885, at Pensacola, Florida, an adult in breeding dress, that is typical of *occidentalis* in color of the under surface and in size (wing 488 mm., culmen 257 mm.), that serves to add this race to the A. O. U. Checklist. The sex is not marked but it is probable that it is a male. I have seen one from Rolle Cay, Great Inagua Island, in the Bahamas, taken June 4, 1879, and several from the coast of Quintana Roo at Puerto Morelos and Contoy Island. At the latter locality birds typical of this race and of *carolinensis* were taken at the same time.

PELECANUS OCCIDENTALIS CAROLINENSIS Gmelin

Pelecanus carolinensis GMELIN, 'Syst. Nat.,' 1 (pt. 2): 571, 1789
(Charleston Harbor, South Carolina).

Larger than *occidentalis*, in breeding plumage averaging lighter on the under surface, and in adult non-breeding dress being usually slightly lighter gray above, though in this character there is considerable variation, and some are not separable; smaller than *californicus*, in breeding dress with the hindneck lighter, more reddish brown.

Males (28 specimens from the United States): wing, 500-550 mm. (526); tail, 123-158 (136); culmen, 280-348 (319); tarsus, 70-89.4 (80.5).

Females (23 specimens from the United States): wing, 483–528 mm. (501); tail, 122–153 (136); culmen, 280–333 (294); tarsus, 68–83.7.

Coasts of the southeastern United States, breeding from South Carolina to Texas, north to North Carolina after the nesting season, casually farther; also ranging along the coasts of Cuba (specimens seen from Cayo Grande de Moa, Oriente, Cachiboca Cay, in the Cayos de Doce Leguas, Camagüey, and Cayos de la Lefia, Pinar del Río), the Bahamas (Andros Island), Navassa Island, Dominican Republic (Samaná Bay, one specimen November 16, 1907), Guadeloupe (several), St. Vincent (Kingston, type of *P. relictus* Thayer), Grenadines (Catholic Rock, near Catholic Island), Trinidad (Soldado Rock, Port of Spain), wandering south to northern Brazil; also Venezuela (Cumaná, recorded by Murphy, Oceanic Birds of South America, 2: 808, 1936), Caribbean coast of Colombia (Pozos Colorados near Gaira, Santa Marta, Puerto Colombia), Canal Zone (Brujas Point), and México (Contoy Island, Quintana Roo); on the Pacific coast of Central America from Panamá (Isla El Rey and San José, Pearl Islands, and Panamá Bay), Costa Rica (Punta Piedra, Guanacaste), El Salvador (Puerto del Triunfo), and Guatemala (San José), probably to southern México.

The actual breeding range of this widely distributed subspecies outside of the United States will have to be plotted through careful examination of birds in their scattered nesting colonies. I have seen only two skins of the Brown Pelican from the Bahama Islands, one from Andros Island which is *carolinensis*, and one from the Inagua group which is *occidentalis*, so that possibly the larger bird is the one of the northern islands while the smaller one occurs in the south. Four specimens from Cuba, from both north and south coasts, are all *carolinensis*, as is one from Navassa Island. Two of the adult Cuban birds in breeding dress are darker below like *occidentalis* but are large like *carolinensis*. One female from Samaná Bay in the Dominican Republic in the American Museum collection (No. 729,035) taken, November 16, 1907, has the wing 506 mm., and the culmen 307 mm. and is apparently a stray of *carolinensis*, as four others from this same area are all typical *occidentalis* in size.

This large race ranges around the western shore of the Gulf of Mexico and the Caribbean Sea, and then follows the northern coast of South America across to Trinidad. Comparatively few birds with complete data are at hand from the southern Lesser Antilles, but I have examined several that are of this race from Guadeloupe. The type of *Pelecanus relictus* described by G. H. Thayer¹ from St. Vincent,

¹ *Pelecanus relictus* G. H. Thayer, The Sentry, Kingstown, St. Vincent, W. I., January 9, 1925 (Kingstown Harbor, St. Vincent).

now in the American Museum of Natural History, is an adult male of *carolinensis* in non-breeding dress, having the wing 523 mm., and the culmen 312 mm. And I have seen two others from Mustique and one from Catholic Rock, near Catholic Island, in the Grenadines. Some of these Lesser Antillean specimens are small, and there seems to be overlap here with birds that in size refer to *occidentalis*. Whether this is due to wandering, or whether this is an area of intergradation between the two forms, remains to be established. I have not examined specimens from the northeastern coast of South America south of Trinidad, where birds are recorded as far south as the Amazon.

It is most interesting that these great birds also range to the Pacific coast in Panamá, and extend north along these shores to Guatemala and probably to southern México. The line of approach or contact between *carolinensis* and *californicus* remains to be determined by specimens taken in breeding plumage at the nesting colonies. Some specimens from the Pearl Islands in the Gulf of Panamá show approach to the new form described beyond from Colombia and Ecuador, but are nearer *carolinensis*. So far as I can determine birds from the Atlantic and Pacific areas here allocated to *carolinensis* are identical.

PELECANUS OCCIDENTALIS CALIFORNICUS Ridgway.

Pelecanus (fuscus?) californicus RIDGWAY, in Baird, Brewer and Ridgway, 'Water Birds of North America,' 2: 143, 1884 (La Paz, Baja California).

Averaging larger than *carolinensis*; in breeding dress the brown of the hindneck much darker, in some specimens almost black.

Males (34 specimens): wing, 520-585 mm. (551); tail, 131-198 (154); culmen, 316-372 (347); tarsus, 76-89.3 (84.5).

Females (23 specimens): wing, 483-569 mm. (519); tail, 130-200 (151); culmen, 298-330 (312); tarsus, 70-82.6 (77.6).

From Monterey County, California, south around the peninsula of Baja California, ranging to the coast of Sonora (Guaymas), the Tres Marias Islands, and probably farther south; in winter north to British Columbia; recorded as a straggler at Guadalupe Island.

While large size marks this form as an average character to separate it from *carolinensis*, smaller individuals can be distinguished certainly under present information only by the color of the hindneck in breeding plumage. The southern extension of the range beyond Baja California and the Tres Marias Islands is, therefore, at present uncertain. An immature male in the National Museum from Acapulco, Guerrero, may be *californicus*, but this is not certain as the measurements (wing 520, culmen 328 mm.) are intermediate. Possibly the sex is wrongly marked.

PELECANUS OCCIDENTALIS URINATOR subsp. nov.

CHARACTERS.—Similar to *Pelecanus occidentalis californicus* Ridgway, but in breeding plumage with hindneck lighter, more chestnut brown as in *carolinensis* and *occidentalis*; in breeding and non-breeding dress averaging darker above, and usually darker below, than *californicus*.

DESCRIPTION.—Type, U. S. National Museum No. 376,743, male adult, in breeding plumage, taken at Hood Island, Galápagos Islands, June 23, 1906, by E. W. Gifford (original number 2953). Feathers of head and a narrow line extending down the side of the pouch to expand into a pointed area on the side of the foreneck white, with a wash of colonial buff on forehead, and to a less degree on crown and sides of head; hindneck to base, with a ring around foreneck extending to the base of the pouch, cameo brown to chocolate, with a slightly darker border of bone brown beside the white line that extends along the pouch, this darker wash broadening distally and extending as a wider area below the expanded end of the white; feathers of back, rump, upper tail coverts and lesser wing coverts dull white centrally along the shaft, edged broadly with dark mouse gray; scapulars smoke gray, with a whitish wash, edged with dark and blackish mouse gray, the dark edgings being relatively wider and more prominent on the smaller feathers; middle wing coverts similar but with dark edgings reduced or absent; greater wing coverts pale smoke gray with faint edgings of deep mouse gray; primaries blackish with shafts light cream color; secondaries and rectrices deep mouse gray with a wash of whitish on outer webs, a white spot with the distal feathers tipped and washed with massicot yellow at the base of the foreneck; sides of extreme upper breast dark mouse gray, with prominent shaft lines of white producing a markedly streaked appearance, the streaks becoming smaller or disappearing toward the median line; rest of under surface mouse gray to deep mouse gray with indistinct shaft lines of dull white, which are wider and more prominent in the center of the lower breast and the upper abdomen; under tail coverts with extensive central areas of whitish; under wing coverts deep mouse gray with irregular central shaft marks of dull white.

MEASUREMENTS.—Males (9 specimens): wing, 552–570 mm. (561); tail, 130–148 (140); culmen, 340–379 (361); tarsus, 81.8–89.4 (84.5).

Females (5 specimens): wing, 516–546 mm. (527); tail, 129–145 (137); culmen, 307–372 (329); tarsus, 77–85.3 (80.4).

Type, male: wing, 559 mm.; tail, 147; culmen, 340; tarsus, 84.6.

RANGE.—The Galápagos Islands.

REMARKS.—For many years the Brown Pelicans of the Galápagos Islands were listed as *P. o. californicus*, though it was recognized that the colony here was isolated, being cut off from any contact with *californicus* along the entire western coast of Central America by the intervention of the smaller *carolinensis*. Swarth recognized the color differences which led him to assign them to *occidentalis*, a name that at that time included the birds of the southeastern United States. The large size of the Galápagos bird is the main point of resemblance between it and *californicus* as the color differences are easily seen.

The series examined comes from Chatham, Narborough, Albemarle, Indefatigable and Hood Islands. The specimen used as the type was obtained from the California Academy of Sciences, through the kindness of Dr. Richard C. Miller and Dr. Robert T. Orr.

PELECANUS OCCIDENTALIS MURPHYI subsp. nov.

CHARACTERS.—Similar in size to *Pelecanus occidentalis carolinensis*, but in color darker above, and more extensively streaked with lighter below; in breeding dress with hindneck darker; separated from *Pelecanus occidentalis californicus* Ridgway by smaller size, more extensive light markings below, and darker dorsal color; similar in dorsal color to *Pelecanus occidentalis urinator* but smaller, and with more extensive light markings below.

DESCRIPTION.—Type, American Museum of Natural History No. 206,988, male adult, in breeding plumage, from Pelado Island, Santa Elena Bay, Ecuador, taken February 14, 1925, by Robert Cushman Murphy and Van Campen Heilner; original number 5010, marked as having testes much enlarged ("t. m. e" on label). Feathers of crown, sides of head, a narrow border on sides of neck along the pouch immediately below head, and a small spot in center where the foreneck joins the breast Naples yellow externally and white basally; line along sides of neck, expanding behind angle of jaw, and extending down to cover base of foreneck (except for Naples yellow spot indicated above) white; slightly elongated nuchal crest Naples yellow anteriorly and white on upper hindneck, with a few scattered white feathers down the median line on the hindneck for three fourths of its length; hindneck, except as indicated, bone brown, with an indefinite median line of Natal brown, the feathers on the lower part of the hindneck Natal brown basally; feathers of back and rump blackish slate, with a broad central streak of white, these light streaks very broad on the rump and upper tail coverts; scapulars partly hair brown and partly fuscous, many of them with a wash of hoary white that disappears in part with wear so that it is not evenly spread; anterior edge of wing and smaller

lesser wing coverts sooty black to fuscous black, lined with white anteriorly, the longer ones and those on the inner half of the wing mixed hair brown, fuscous and fuscous black; middle wing coverts hair brown and fuscous black; alula dull black; primaries fuscous black, with shafts ivory white basally, changing distally to dull black; secondaries sooty black, with a wash of grayish white on outer webs; under surface mouse gray to deep mouse gray, the dark color being especially prominent on the upper breast, with narrow median shaft lines of dull white, these being more prominent on lower breast and abdomen; sides, flanks and under wing coverts fuscous black with wide shaft lines of white; rectrices hair brown to mouse gray, the less worn feathers with a wash of whitish on outer webs.

MEASUREMENTS.—Males (11 specimens): wing, 505–526 mm. (513); tail, 127–162 (135); culmen, 310–346 (328); tarsus, 69–81.2 (77.4).

Females (8 specimens): wing, 478–494 mm. (485); tail, 123–175 (139); culmen, 289–297 (293); tarsus, 61–75.7 (70.7).

Type, male: wing, 513 mm.; tail, 126; culmen, 340; tarsus 78.4.

RANGE.—Pacific coast of Colombia (Octavia Rocks, Bahía de Málaga, Gorgonilla Island) and Ecuador (Vaquería, Isla Silva Sur, and Río San Antonio, Prov. de Los Ríos, Isla de Jambelí, Prov. de Oro, Santa Elena, Punta Salinas, and Pelado Island, Bahía de Santa Elena, Prov. de Guayas); ranging south to Talara, Perú.

REMARKS.—Previously these birds have been placed with *carolinensis* because of their agreement in size with that form, but the color differences are definite and distinctive. In breeding dress the hindneck is darker, much as in *californicus*. Birds from the Pacific coast of Colombia begin to grade over toward *carolinensis*, but appear nearer to *murphyi*. Thus, a female from Gorgonilla Island is like *carolinensis* below but is darker above, a female from farther north at Bahía de Málaga is identical with specimens from Ecuador, and a male from Octavia Rocks a short distance south of the boundary between Panamá and Colombia is like the specimens from Gorgonilla Island. It may be remarked that birds from the Pearl Islands in the Gulf of Panamá are also slightly intermediate but are to be placed with *carolinensis*.

The Ecuadorian and Peruvian birds seem to resemble *californicus* closely in the very dark color of the hindneck in breeding dress, but differ from that form in darker dorsal color and more extensive white markings below, as well as in average smaller size. Occasional specimens of *carolinensis* from the southeastern United States are equally dark on the hindneck, however. The dark hindneck shows in some specimens from the Pearl Islands, Panamá, being further indication

that birds from that area are intermediate, though near *carolinensis*. In color, *murphyi* shows some approach to *thagus* but in the series examined I have not seen any that might be considered intermediate in size, nor do any display the head caruncles characteristic of adult *thagus*.

This form is named for Dr. Robert Cushman Murphy in recognition of his extended studies of this interesting group of birds.

PELECANUS OCCIDENTALIS THAGUS Molina

Pelecanus Thagus MOLINA, 'Sagg. Stor. Nat. Chili': 240, 1782 (Chile).

Largest of all the forms; in breeding dress much lighter below, the feathers of the under surface of the body being finely streaked with white along the shaft; occipital crest more prominently developed; hindneck dark brown as in *californicus*; a growth of caruncles on the bare skin between the base of the culmen and the eye; pouch and bill more brilliantly colored in the breeding season; immature darker on the head and dorsal surface than the corresponding age in *carolinensis*.

RANGE.—From the northern end of the Humboldt Current, coast of Perú (specimens seen from Cabo Blanco, Lagarto Head, Chincha Islands, Ancon, Lobos de Tierra Island) southward to central Chile (specimens seen from Papudo, Concón and Corral), casually farther to Ancud, Chiloé Island, and even to Picton Island at the eastern end of Beagle Channel, Tierra del Fuego.

Males (6 specimens): wing, 575–625 mm. (606); tail, 140–177 (152); culmen, 340–425 (397); tarsus, 95–112.7 (105.9).

Females (14 specimens): wing, 520–606 mm. (576); tail, 135–174 (146); culmen, 332–390 (354); tarsus, 87–107 (100).

REMARKS.—The fully adult bird of both sexes has the bare skin of the upper margin of the loral region and the adjacent sides of the frontal area from above the anterior (inner) canthus of the eye to the base of the bill, immediately behind the groove between the culmen and the sides of the bill, covered with rough, narrow, irregularly formed, closely placed caruncles that cover an elongated elliptical area. In one male (Amer. Mus. Nat. Hist. 729,060) this measures 39 mm. long by 13 mm. broad, with the free points elevated 4 to 5 mm. Smaller, irregularly placed horny papillae are found on the semicircular base of the culmen, and also around the base of the lower mandible below the gape. This peculiar development is most prominent in males, but is found to a lesser degree in females. It begins to appear as the young bird changes from the grayish-necked immature dress to the white neck of the next stage of plumage. I have not found these papillae in any other Brown Pelicans.

The brilliant color of the bare skin of the head and pouch shows considerable variation, traces of the pigment frequently persisting in the dried skin.

The light coloration of the lower surface in the adult is prominent, carrying to an extreme this tendency found in the smaller *murphyi* immediately to the north. The lower surface has the feathers white basally, with a distinct line of white down the shaft to the tip, bordered on this distal portion with gray. The lower surface, therefore, from the base of the neck to the tail is distinctly streaked. As the season advances the dark portions wear away and the basal white correspondingly becomes more prominent. In younger birds that are changing to adult plumage, the lower surface remains extensively white centrally, and above, these birds are more heavily streaked.

The markedly larger size, the caruncles on the bill in the adult, and the brighter coloration of the bare skin of the head and pouch are so different from what is found in other Brown Pelicans that it may develop with complete information that *thagus* should stand as a species.

Smithsonian Institution

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A NEW SWIFT FROM CENTRAL AND SOUTH AMERICA

BY JOHN T. ZIMMER

IN a collection of Colombian birds submitted for identification and study a short time ago by Brother Nicéforo María of the Instituto de la Salle, Bogotá, there was found to my astonishment a specimen of *Cypseloides cherriei*, previously known only from two skins collected on the top of Mt. Irazú, Costa Rica, and preserved in the U. S. National Museum. Through the kindness of Dr. Herbert Friedmann of that institution, I have been enabled to study the type and paratype from which the Colombian bird, taken at San Gil, Santander, in January, 1939, by Brother Nicéforo María (No. 308462, American Museum of Natural History), differs principally by the possession of a narrow white chin spot.

This difference, even though slight, is positive and in view of the wide hiatus in the localities, I was at first disposed to regard the Colombian bird as subspecifically distinct from the Costa Rican examples. Before committing myself to the description of a new form, however, I made a careful examination of other Neotropical forms of the genus *Cypseloides* to determine the probability of individual variations in the

direction noted in some other species. The result was another surprising discovery of another sort.

There is another species of swift in the Americas that occasionally has a white chin. Examples of this bird have been identified as "*Cypseloides fumigatus*" and "*Nephocetes niger costaricensis*," but they are, in reality, quite distinct. Just how far this confusion has extended it is impossible to say without an examination of all the pertinent material, but it is quite possible that other specimens will be found that have been similarly misidentified.

The first ray of light appeared with a specimen from São Francisco de Paula, Rio Grande do Sul, Brazil, which, from the general position of the locality, should represent true *fumigatus*. There is some confusion with respect to the type locality of *fumigatus* which was described by Streubel (Isis, 5: col. 366, 1848) from "Paraguay" (ex Natterer) and "Brasilien" (ex Müller), with the name credited to Natterer's manuscript designation of a bird presented to the Berlin Museum. There is no authentic record of the species from Paraguay and Natterer obtained none in that country. Burmeister (Syst. Uebers. Thiere Brasiliens, 2: 367, 1856) cites Natterer's bird in the Berlin Museum as from "Para" which is equally puzzling. In the report on Natterer's collections, Pelzeln (Orn. Bras.: 16, 1868) gives three localities for *fumigatus* of which two are in the state of São Paulo, and one in Paraná (Curytiba), and it seems rather clear that Streubel's "Paraguay" and Burmeister's "Para" should be interpreted as Paraná. Accordingly, I propose the restriction of the type locality of *Hemiprocne fumigata* Streubel to Curytiba, Paraná, Brazil.

In any case, the São Francisco de Paula bird, an adult male, agrees well with the better-known *C. f. major* Rothschild, of Tucumán, Argentina, from which it differs by being distinctly darker in general coloration and slightly smaller than most of its own sex of that form. Two Argentine examples, both sexed as males, are still smaller but agree in this respect with an Argentine female, and it is possible that at least one of them is wrongly sexed. At any rate, *fumigatus fumigatus* is certainly no more than subspecifically distinct from *f. major* and I revert to the trinomial for both forms.

To substantiate this belief, I wrote to Dr. Olivério Pinto of the Department of Zoology, Secretariat of Agriculture, Industry and Commerce, São Paulo, for critical data on several east-Brazilian skins at his command, and Dr. Pinto's kind reply amply confirms the characters of east-Brazilian birds, representing *fumigatus*.

Three specimens misidentified as *fumigatus*, from British Guiana, eastern Venezuela, and Perú, were compared with the São Francisco de

Paula example of *fumigatus* and found to represent a very distinct species. Somewhat later a fourth example was found from Costa Rica, identified as "*Nephocetes niger costaricensis*," and still more recently another specimen from eastern Venezuela, in the collection of Mr. William H. Phelps of Caracas, has been available through the kindness of Mr. Phelps. With five specimens from a variety of localities, the distinction and variations of the new species can be determined in some detail. The new bird may, therefore, be known as follows.

***Cypseloides cryptus*, new species**

TYPE from Inca Mine, Río Tavara, Perú. No. 72095, American Museum of Natural History. Adult male collected November 16, 1899, by H. H. Keays. Original No. 5.

DIAGNOSIS.—Differs from *C. fumigatus* and *C. niger* by shorter wing but longer tarsus; bill smaller and with culmen more sharply arcuate; nostril usually more rounded, less elongate, and with the adjacent feathering less advanced anteriad on the outer margin (not reaching the anterior end of the nostril) though a little more advanced on the inner margin than in *fumigatus* and *niger*; plumage somewhat duller and without pronounced metallic gloss; tail even (as in *fumigatus*) but somewhat stiffer; pale markings on the top of the head restricted to the sides of the forehead; chin often markedly white.

RANGE.—Known from Perú, British Guiana, mountains of eastern Venezuela, Costa Rica, and probably Panamá.

DESCRIPTION OF TYPE.—Upper parts dark Chaetura Drab;¹ sides of forehead paler, with narrow whitish tips; a narrow line of feathers with fine, white terminal margins extending over the lores posteriad above the middle of the orbit; a slight suggestion of a pale area just behind the eye; anterior part of lores Hair Brown; posterior part occupied by a lunate patch of deep black, with the bases of the feathers distinctly paler. Under parts Hair Brown \times Chaetura Drab but with the chin clear white; throat with rather prominent dark shafts. Exposed surfaces of wings and tail a little lighter than Chaetura Black. Shafts of remiges and rectrices black above, pale brownish beneath. Tail nearly even, being forked about 1 mm. Bill and feet (in dried skin) blackish. Wing, 136.5 mm.; tail, 43; exposed culmen, 5.3; culmen from base, 9; tarsus 16.

REMARKS.—A specimen from Kaietur Falls, British Guiana, and one from Mt. Auyan-tepui, Venezuela, both without indicated sex,

¹ Names of colors are capitalized when direct comparison has been made with Ridgway's 'Color Standards and Color Nomenclature.'

differ from the type by having the chin-spot varied by dark shaft-stripes. A female from Sororan-tepui, Venezuela, and one from San Pedro, Costa Rica, have the chin-spot virtually obsolete, although there is a slight suggestion of it at the very point of the chin in both examples. The Costa Rican bird further has the whole belly and under tail-coverts marked by broad white tips on the feathers. These are slightly indicated in the British Guianan and the Venezuelan birds but are lacking in the type.

How much of this variation between the clear white chin of the type and the dark chin of the two known females is due to individual or sexual variation is still to be determined. The fact that the Sororan-tepui and Auyan-tepui birds are different in this respect while the Costa Rican specimen agrees with the Sororan-tepui example, strongly suggests that the pure white throat of the Peruvian skin is no more than an extreme condition of individual variation.

It may be noted that a slight trace of white on the chin is sometimes to be found in *C. niger*—at least as much as in the minimum development of that character in *cryptus*.

There is much the same bill and feathering of the nostrils in *C. cherriei* as in *cryptus*, and the feet of *cherriei*, although actually as small as in *niger* and *fumigatus*, are relatively larger in proportion to the length of the wing, being between the figures for *niger* and *fumigatus* and those for *cryptus*. In the same ways, "*Aërornis*" *senex* is like *cryptus*. The curvature of the bill and the nostril feathering are the same and the feet, although apparently much heavier, are not so in proportion to the length of wing.

I can see no good reason, therefore, to recognize the genus "*Aërornis*" for which I can find no satisfactory characters. It was long included in *Cypseloides* and its original description by Bertoni (Anal. Cient. Paraguayos, ser. 1, 1: 66, 1901) was in distinction from *Chaetura*, which distinction I concede. Unfortunately, Bertoni earlier (Revista de Agronomia, 2: 58, 1900) applied the name *Chaetura major* to the species *senex* and this, with the inclusion of *senex* in *Cypseloides*, necessitates another name for *Cypseloides major* Rothschild (Bull. Brit. Orn. Club, 52: 36, 1931) for which I propose the name *Cypseloides fumigatus rothschildi*.

There appears to be even less necessity to recognize "*Nephocetes*" (originally *Nephocaetes*) as distinct from *Cypseloides*. The forked tail of "*Nephocetes*" and the unforked one of *Cypseloides* are the only criteria that are available, and the distinction is not constant. Females of the *niger* group sometimes have no more emargination of the tail than various examples of the *fumigatus* group where the sexes are

alike in this respect. I consider "*Nephoeetes*," therefore, as a synonym of *Cypseloides*.

The range of *C. cryptus* is probably extensive through the mountains of western and northern South America. There is a record of "*fumigatus*" from Coshipata, southeastern Perú, which is doubtful. Taczanowski's description (Orn. Pérou, 1: 232, 1884) of the critical specimen notes an entirely fuliginous color, which is not determinative, but gives the tarsal length as only 13 mm., agreeing with *fumigatus* or *major* but not with *cryptus*. There is also a record of "*fumigatus*" from Gualajiza, Ecuador (Salvadori and Festa, Boll. Mus. Zoöl. ed Comp. Univ. Torino, 15, no. 368: 13, 1900) but no description nor measurements are available. Hartert (Cat. Birds British Mus., 14: 496, 1892) lists the Coshipata bird, three Brazilian skins, and one Ecuadorian example under "*fumigatus*" without mention of a white chin-spot in any of them but with a minimum wing-length of 144.8 mm. (converted). The same author (Tierreich, Aves, 1: 80, 1897), records "*fumigatus*" from Brazil, Perú, and Ecuador, without mention of a white chin and with a minimum wing-length of 144 mm. None of these accounts points definitely toward *cryptus* but there is no assurance that some of the records or references do not pertain to that species. Rogers (Auk, 56: 83, 1939) assigns a specimen from Port Obaldia, Panamá, to *fumigatus* after comparison with the British Guianan, Peruvian, and Auyan-tepui birds in the American Museum collection, and notes the white chin and large feet as characters of *fumigatus* on the basis of which he proposed the specific separation of *fumigatus* and *major*. There is no doubt, therefore, that the Port Obaldia bird belongs to *cryptus*.

I am puzzled by the poor development of the white tips on the feathers of the belly in the Sororan-tepui example of *cryptus*, sexed as a female by the collector, Fulvio Benedetti, who is particularly reliable in this particular as I am informed by Mr. Phelps. The Costa Rican female, on the other hand, has quite broad white tips on the feathers of the lower under parts. As a rule, the relative prominence of these spots in the two sexes of all the species of *Cyseloides* is a good character for sexual distinction, although it is not always exact. Some males may show a slight development of white at the tips of these feathers and occasionally a female will have less than the others. Of the two small examples of *C. fumigatus rothschildi* mentioned earlier, one has strong white ventral spotting in agreement with the bird sexed as a female and is certainly of that sex; the other lacks the white marking and may be only a small male.

The proportionate amount of white in the sexes differs among the

various subspecies of *C. niger*. In typical *C. n. niger*, even the females have but a little white at the tips of the ventral feathers, but there is always some of it. In *borealis*, the tips are broader and the males more often show some trace of narrow pale tips. In *costaricensis*, there is about the same development as in *borealis*, judging by the few specimens I have seen. These distinctions have, at least in part, been pointed out by Ridgway (Bull. U. S. Nat. Mus., 50, pt. 5: 707, footnote b, 1911), but he makes no mention of another feature that is important. This is the relative depth of fork in the tails of the two sexes of the species in question. In eighteen males of *niger*, the tail is forked for a depth of 8-16 mm. (av. 12.2), although two doubtful skins show only 3 and 5 mm., respectively. Eight females have the fork 0-8 (av., 4.5). In *borealis*, eleven males have the fork 5-11 mm. (av., 8.5), with another doubtful skin only 2, possibly due to wear. Nine females show 0-3 (av., 1). Two males of *costaricensis* have the fork but 7 mm. each, and one female has it 3. Four females in all—three of *borealis* and one of *niger*—have the tail virtually even, and this fact, with the amount of variation shown by the remainder of the series, furnishes evidence as to the poor value of the forked tail of "*Nephoeetes*" as a generic character. It may be added that one male of *borealis* from Monterey County, California, has the tail distinctly rounded, with the outer rectrices 4 mm. shorter than the median ones. The significance of this peculiarity is not evident, but it may possibly be due to age distinction.

The following figures show the tarsus/wing indexes of the different forms of *Cypseloides* as determined from the specimens examined:

- C. n. niger*: ♂, 7.83; ♀, 8.24
- C. n. borealis*: ♂, 7.57; ♀, 7.65
- C. n. costaricensis*: ♂, 7.71; ♀, 7.74
- C. f. fumigatus*: ♂, 7.84; ♀, 8.33
- C. f. rothschildi*: ♂, 8.42; ♀, 9.15
- C. cherriei*: ♂, 9.84; ♀, 9.70
- C. cryptus*: ♂, 11.8; ♀, 11.8
- C. senex*: ♀, 11.6

In conclusion, I wish to express my gratitude to Brother Nicéforo María of Bogotá, Colombia, who generously presented the Colombian specimen of *Cypseloides cherriei* to the American Museum of Natural History; to Dr. Herbert Friedmann of the U. S. National Museum for the loan of critical material; to Mr. William H. Phelps of Caracas, Venezuela, for similar courtesy; and to Dr. Olivério Pinto of São Paulo, Brazil, for valuable notes on certain specimens as detailed in the foregoing account.

SPECIMENS EXAMINED

C. cherriei.—

COSTA RICA:

Mt. Irazú, 1 ♂ (type)¹, 1 [? ♀]¹.

COLOMBIA:

San Gil, Santander, 1 [? ♀].

C. cryptus.—

PERU:

Inca Mine, 1 ♂ (type).

VENEZUELA:

Mt. Auyan-tepui, 1 [? ♂];

Mt. Ptari-tepui, 1 ♀².

COSTA RICA:

San Pedro, 1 ♀.

BRITISH GUIANA:

Kaietur Falls, 1 [? ♂].

C. f. fumigatus.—

BRAZIL:

São Francisco de Paula, Rio Grande
do Sul, 1 ♂.*C. f. rothschildi*.—

ARGENTINA:

Tapia, Tucumán, 1 ♂ (type), 1

"♂" [? = ♀];

Tucumán, 1 ♂, 1 ♀;

Perico, Jujuy, 1 ♂;

Rosario de Lerma, Salta, 2 ♂.

C. f. rothschildi (cont.).—

BOLIVIA:

Tarija, 1 ♂¹.*C. n. niger*.—

SANTO DOMINGO: 7 ♂, 2 ♀.

ST. ANDREWS IS.: 1 ♂.

JAMAICA: 1 ♀.

DOMINICA: 2 ♂, 3 ♀, 2 [?].

GUADELOUPE: 2 ♂.

ST. VINCENT: 2 ♂.

CUBA: 5 ♂, 2 ♀.

C. n. borealis.—

U. S. A.

Colorado, 2 ♀;

California, 1 ♂, 1 ♀;

Washington, 1 ♀.

CANADA:

British Columbia, 12 ♂, 5 ♀.

C. n. costaricensis.—

COSTA RICA:

San Pedro, 1 ♂, 1 ♀;

El Pozo, 1 ♂.

C. senex.—

BRAZIL:

Chapada, Matto Grosso, 1 ♀.

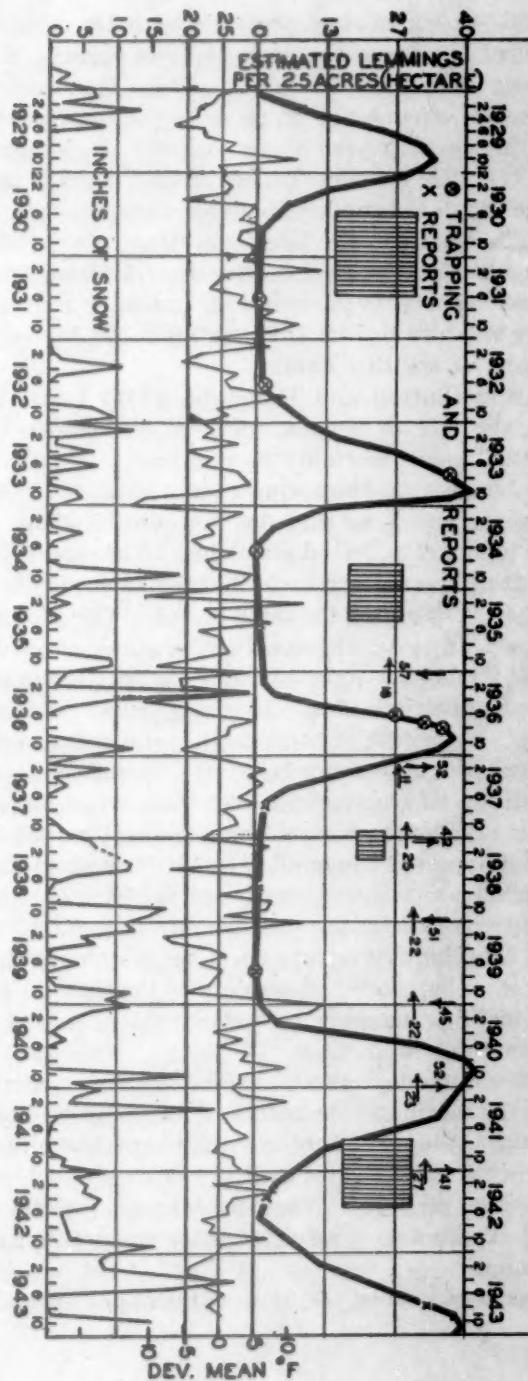
American Museum of Natural History
New York, N. Y.

THE RELATION OF SNOWY OWL MIGRATION TO THE
ABUNDANCE OF THE COLLARED LEMMING

BY V. E. SHELFORD

IN 1943 the writer published a description of the variations of the abundance of collared lemming in the Churchill area. It was found that increases in abundance were correlated with heavy snowfall in mild winters and that declines were associated with absence of snow and presences of predatory birds in the area. A colleague had expressed the view that the Snowy Owl, which is one of the important enemies of the lemmings, came south when the lemmings were abundant. This suggestion, coupled with the appearance of published reports of the large southward migration of Snowy Owls in the winter

¹ Specimens in the U. S. National Museum.² Specimen in collection of William H. Phelps, Caracas.



DESCRIPTION OF TEXT-FIGURE II

The heavy curve shows the relative abundance of lemmings as estimated in numbers per hectare (25 acres) in the Churchill area in 1929 to 1943. The diameters of the shaded squares represent the relative abundance of southward migrating Snowy Owls in New England as estimated by Dr. A. O. Gross. The arrows refer to the Snowy Owl population as indicated by the Canadian Arctic Wild Life Inquiry (see Clift and associates in list of references cited). Arrows pointing upward indicate increases in owl population; the percentage of returns of individual cooperators reporting increase is represented by the adjacent figures (adjacent figures indicate percentage in all cases). Arrows pointing downward indicate decreases in population. Horizontal arrows indicate no change. The center curve indicates deviations above and below normal monthly temperature in degrees F. The lowest curve indicates snowfall in inches.

of 1941-42, led to correspondence with Dr. A. O. Gross, who has kept excellent records of the appearance of Snowy Owls in New England. He was kind enough to supply data. Previously, Dr. G. M. Sutton had called attention to his published winter observations on lemmings and Snowy Owls which was overlooked. Additional lemming data for 1941, 1942 and 1943 from I. H. Smith made possible the extension of the graph of lemming abundance at Churchill. The reports of the Canadian Arctic Wild Life Enquiry are also available and this paper is an attempt to correlate the several phenomena indicated by the several reports. The writer is indebted to the gentlemen named above and also to Mr. J. Patterson of the Meteorological Division of Canada for weather data.

Sutton (Sutton and Hamilton, 1932) found lemmings abundant from the last of August, 1929 to the middle of July, 1930. He reported heavy mortality in mid-June. They were drowned out of their burrows by the spring thaw. Some were dead on the tundra, and some dead ones were floating down streams. They were preyed upon by many birds and mammals. The reports for Churchill showed that there were many in 1929, May to September, and considerably fewer in 1930 during the same period. This indicates that the decline was probably general preceding the winter of 1930-1931 (Text-fig. 1).

The Canadian Arctic Wild Life Enquiry began in 1935 and has been carried on through 1942. It made possible comparison of the different areas. There was, in some cases, a difference of one year in the time of maximum abundance between Churchill and some of the northern localities. At Chesterfield Inlet there was a large increase in rodents (all small rodents are considered together) in 1939 while lemmings were at a minimum at Churchill. In 1940 lemmings rose to a maximum at Churchill and showed continued increase at Chesterfield. This is indicative of the minor variations from point to point in the tundra. Wild Life Enquiry reports cover the trapper year, beginning in June, August, or September, depending on the time the trapper moved away from his trapping grounds to market his skins and secure supplies, and the length of his stay.

It was found in connection with the lemming study at Churchill, that while the maximum abundance of mice appeared to precede that of the lemmings, the minima of both mice and lemmings came at the same time in that area. This tendency probably prolongs the large population effects on predators and accentuates the minima. It is probably to be expected as a result of space competition during the lemming maximum.

Recent reports on the dates of the appearance of the Snowy Owls in

New York and New England have indicated that they came south following years in which there was a sharp decline in lemming population. In the discussion of lemming declines (Shelford, 1943) predation was considered the chief cause. One of the principal predators credited with reducing the number of lemmings from the large populations shown in Text-figure 1 was the Snowy Owl. The figures below were supplied by Dr. A. O. Gross.

Relative abundance of Snowy Owls in New England during winter of southward migration, 1926 to 1942.

1926-1927	10
1930-1931	6
1934-1935	4
1937-1938	2
1941-1942	5

The estimates have been given expression in Text-figure 1 by using Dr. Gross's figure as the diameter of a shaded square placed with its center on January 1.

In 1940, 1941, and 1942 there was general agreement throughout the North American tundra both as to rodent abundance and weather conditions, especially heavy snowfall and moderate temperatures. For this reason the right-hand portion of Text-figure 1 will be discussed first. A comparison of the Snowy Owl squares with the lemming curve shows that there was a large owl migration following the sharp decline in lemmings and other rodents outside the Churchill area in 1941-1942. In connection with each year the percentage of reports showing an increase or decrease of Snowy Owls (whichever was larger) is shown. In this period (1940-1942) the reports of increases and no change made up 68% to 75% of the Wild Life Enquiry reports from coöperating individuals.

Turning attention to the earlier years (1929 to 1939) when there are no records except at Churchill (1929-1935), there was some variation in different parts of the tundra as to the years in which rodents were abundant (1935-1939). However, the same general relations hold good. There was southward migration of owls following each decline in lemming population. There is also indication of a decline in owl population in the second and third years following the periods of low rodent population as indicated at Churchill. There was an October peak of lemming population followed by a decline during the following winter and spring; e. g., in 1933 the decline in rodents took place in the winter of 1933-1934. The owl migration came in the winter of 1934-1935. The Wild Life Enquiry showed a decline in owl

population the following year. This series of events was essentially duplicated in 1936-1939. For the period covered by the report, a decline in owl population is suggested for one or more years following a southward migration. The difference in the size of the southward migrating Snowy Owl population is probably related to the somewhat spotty distribution of large populations of rodents which enable them to find their prey by migration from place to place within the tundra in years for which rodent declines are not quite general.

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OBSERVATIONS ON YOUNG TARSOMETATARSI OF THE FOSSIL TURKEY *PARAPAVO CALIFORNICUS* (MILLER)

BY HILDEGARDE HOWARD

Plate 25

THE abundance of turkeys [*Parapavo californicus* (Miller)] in the Pleistocene deposits of Rancho La Brea, California, has been frequently commented upon in previous publications, and the presence of large numbers of young turkey bones has led to the conclusion that the species must have bred in the region of the tar traps.

In the Rancho La Brea collections at the Los Angeles County Museum, the series of turkey tarsometatarsi, alone, numbers well over

a thousand bones, and represents more than 750 individual birds. These range in size from apparently newly hatched chicks, to full grown gobblers.

In about 205 of the represented birds, the tarsus had not yet fully united with the metatarsi. In another 75, the metatarsals, though completely united with the tarsal element, still show a roughness of texture indicating immaturity, and no sign of spur development is evident in the male (large) bones. In modern turkeys under domestication, the male bird shows the first sign of spur development in six to eight months after hatching, depending upon the breed. According to the U. S. Department of Agriculture, Bureau of Animal Industry, observations on wild birds raised in captivity indicate close similarity between wild and domestic forms in this respect. The fossil species presumably would not have varied greatly from the modern birds, and it may safely be said that at least 275 of the turkeys entrapped at Rancho La Brea were under a year old.

These young bones were distributed through ten or twelve different pits so do not indicate a mass entrapment of birds of a single flock. It is more reasonable to assume that the bones represent a random trapping such as might have been expected over a period of years in this area if a ground-dwelling bird nested and raised its young in proximity to the tar traps. That many young grew to adulthood in the region in spite of the tar is suggested by the presence of bones of close to 500 fully grown male and female turkeys.

Of the several considerations which present themselves as a result of the recovery of these young turkey bones, one of the most important is the study of the immature bones themselves. The excellent series of tarsometatarsi, in particular, affords a rare opportunity to observe growth stages in this composite element, and is of value not only because of the geologic age of the species, but as a means of contributing to the general knowledge of bone development.

The collection of tarsometatarsi falls, roughly, into nine groups according to stage of development, as follows:

GROUP I. (Plate 25, upper figure *a* and *b*)—22 specimens.¹ Bone porous with both ends very spongy. Shaft not straight as in adults, but flaring gradually both proximally and distally from a point slightly below center of bone.

GROUP II. (Plate 25, upper figure, *c*)—15 specimens. Bone still porous, but shaft straighter and relatively longer, so that proximal and distal ends flare more abruptly at either end of shaft.

¹ Number of specimens refers to complete bones only and does not include the many fragmentary specimens of each group which are available.

GROUP III. (Plate 25, upper figure, *d*)—29 specimens. Bone less porous. Facets of distal trochleae assuming recognizable contours. Shaft fairly straight between flared ends. Distal foramina still incomplete.

GROUP IV. (Plate 25, upper figure, *e*)—22 specimens. Distal end nearly completely formed except external foramen not entirely closed off. Proximal end still spongy.

GROUP V. (Plate 25, upper figure, *f*)—17 specimens. Proximal end less porous, and flattened for union with tarsus. Tarsal element not yet joined. Distal end fully ossified, with foramina complete.

GROUP VI. (Plate 25, upper figure, *g*)—30 specimens. Tarsus uniting with metatarsals, but union still incomplete.

GROUP VII. (Plate 25, upper figure, *h*)—56 specimens. Tarsus completely fused with metatarsals, but proximal part of metatarsals still porous, and tubercle for tibialis anticus roughly formed, or not yet present.

GROUP VIII. 27 male specimens. Bone apparently fully ossified except shaft which shows slight graininess of texture. Spur core not yet formed. Thirty-six bones of females which show similar graininess of texture are placed in this group also.

GROUP IX. Fully grown adult bones. Males with spur core.

Bones of males and females are readily distinguished in the adult stage by the presence of the spur core in the male, as well as by generally smaller size in the female. Within the younger groups, it is possible to separate the sexes on the basis of size of the bones within a given developmental group. Although male bones at one stage of growth may overlap in length those of the females of the next succeeding group, the stage of development, as well as generally greater sturdiness in the male bones, serves to distinguish between them.

In the first group, variation in size appears to be entirely due to age rather than to sex. In the second group, sex variation is not marked but strongly suggested; there are a few bones which are slightly shorter and noticeably more slender than the rest. These are regarded as females, the rest males. In Group III, the proportions of male and female bones are more clearly indicated.

The age of the birds represented in these groups can be only roughly estimated. In Group I, the youngest birds were probably no more than a week old; the larger bones may represent birds of 4 or 5 weeks. Studies by Jaap, Penquite, and Thompson (*Poultry Sci.*, 22: 11-19, 1943), as well as Harshaw, Titus and Fritz (*Jour. Agric. Res.*, 48: 997-1008, 1934), on bone development in chickens, indicate that size

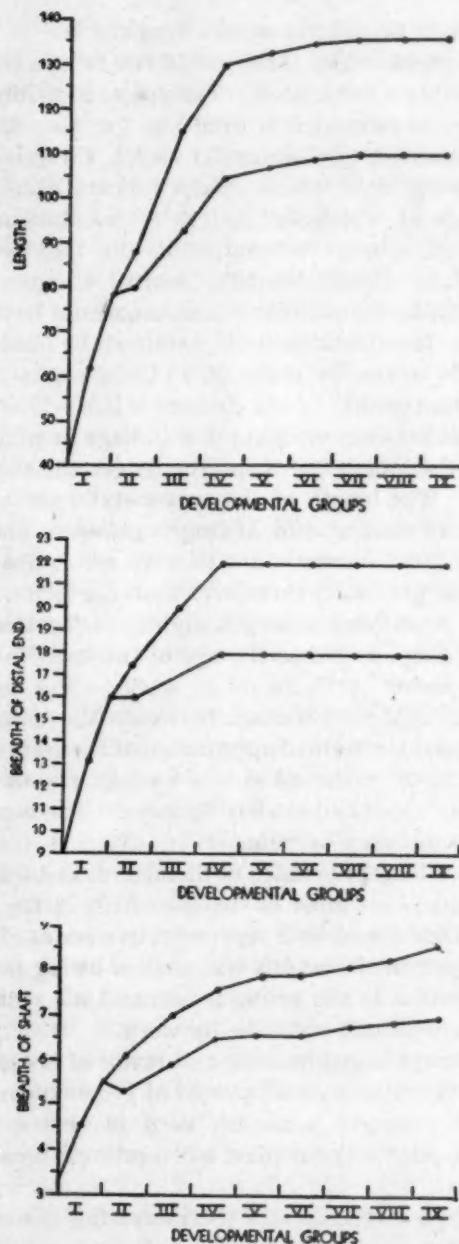
distinction of sexes in these birds occurs from the 4th to the 6th week depending on the breed. The time should not be markedly different in the turkey, possibly a little later. The age of individuals in Group II might, therefore, be estimated at from 5 to 7 or 8 weeks.

For stages represented by Groups III to VI, there is no available information on living birds which would indicate age. Group VII, however, the stage at which full length of the tarsometatarsus is apparently attained, can be estimated on the basis of studies on domestic fowl. Jaap (Proc. World's Poultry Congr. and Expos., 1939: 68-70) and Milby (unpublished measurements) have shown that full length of the tarsometatarsus is attained by female domestic turkeys at 22 to 24 weeks, by males at 26 to 28 weeks. In chickens the time of maximum growth of the element is less. There appears to be some correlation between ultimate size and age at which this size is attained; that is, the longer the bone, the longer time is required for complete growth. The length of the tarsometatarsus in *Parapavo* is about 90 per cent of that of wild *Meleagris gallopavo* and of still less proportion to the large domestic breeds with which Jaap and Milby are working. It is probable, therefore, that the tarsometatarsus of *Parapavo* reached its maximum length slightly earlier than is the case in the domestic turkey, and that the age of the individuals in Group VII ranges from about 21 to 26 or 27 weeks. The male bones of Group VIII, which represent a stage between the time of attaining full linear growth and the time of appearance of the spur core, possibly include ages from 27-28 weeks up to 32-34 weeks, if spur development is comparable in the fossil and modern turkeys. The bones of females assigned to this group may be younger.

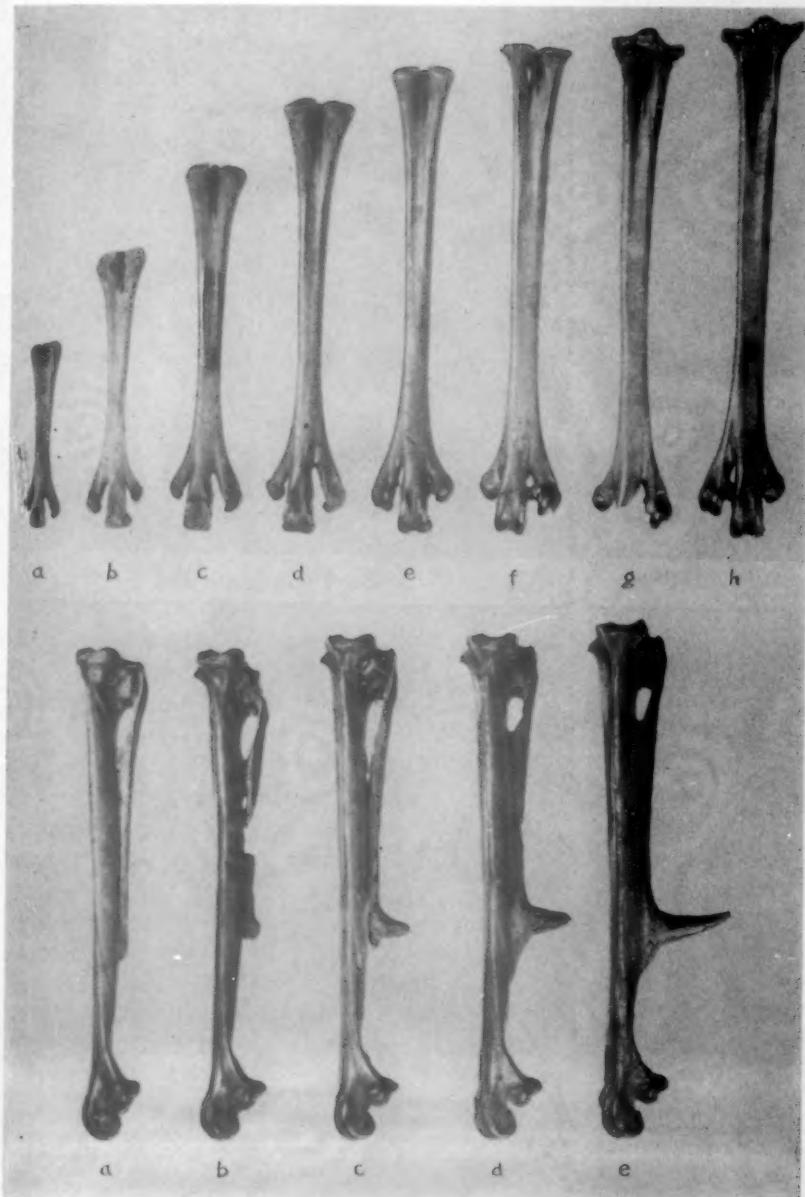
Measurements of length, breadth of distal end, and least breadth of shaft have been made on most of the specimens in the eight groups of subadult individuals, and on a representative series of adult bones. Measurement of proximal breadth was useless owing to the extreme porosity of this portion in the young bones, and the number of specimens in which the proximal end is badly worn.

Table I lists average measurements and ratios of breadth to length, showing progressive steps in development of proportions in the different groups. The youngest bones are seen to be the shortest and narrowest, but are relatively broadest when ratio of breadth to length is taken.

Text-figure 1 depicts graphically the increasing dimensions of the element through the several groups. In all bones of Groups VI to VIII, as well as those of the adult series, an adjustment has been made for the addition of the tarsus. As the tarsal cap is found to



TEXT-FIGURE 1.—Graphs depicting measurements (in millimeters) of tarsometatarsi of *Parapavo* in each of the nine groups. In all except Group I only the average measurement is given for each sex. In Group I, where sex difference in size is not discernible, and variation is due to age, minimum and maximum measurements are given as well as the average. X = Stage at which maximum growth is reached.



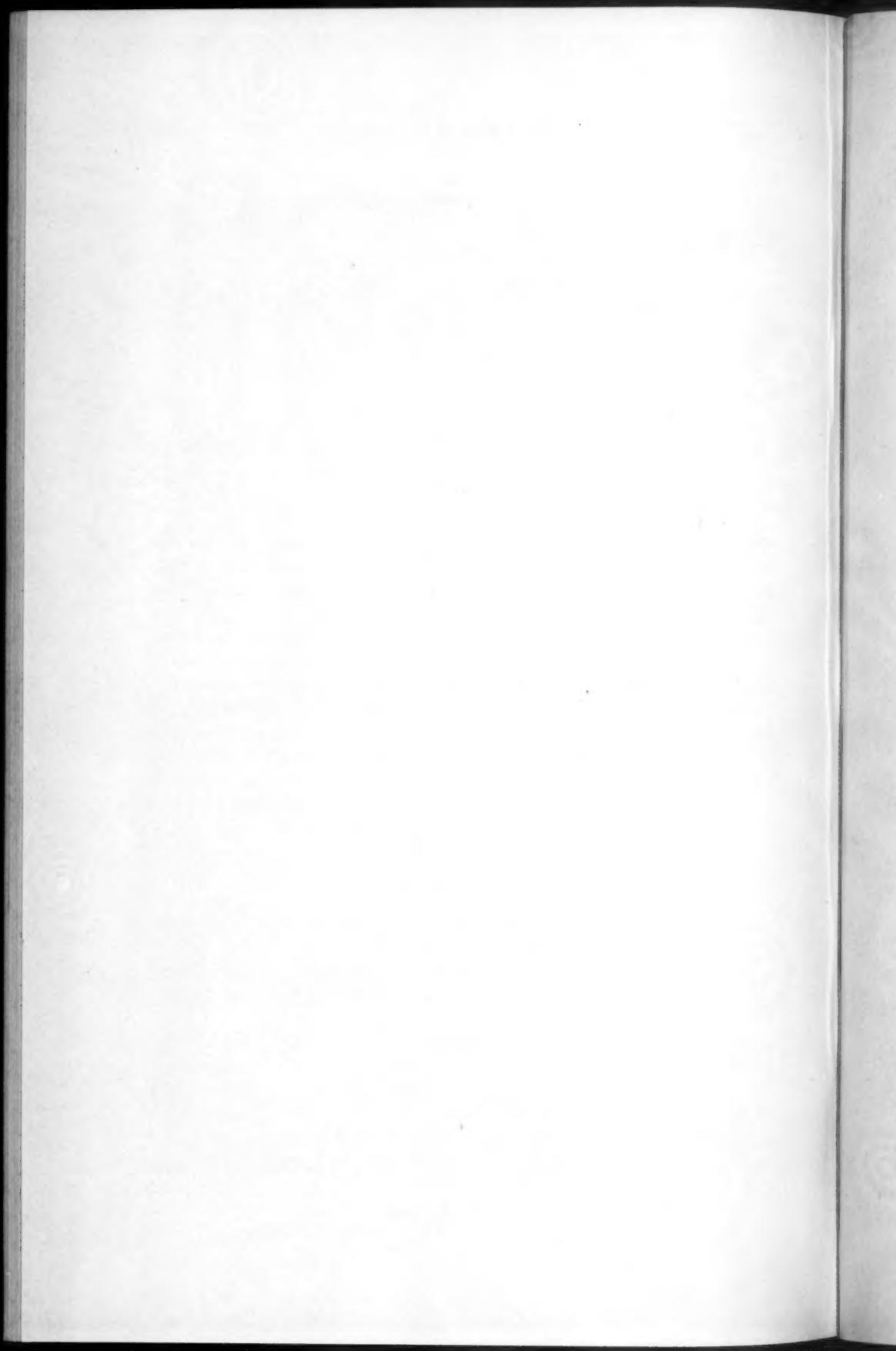


TABLE I

AVERAGE MEASUREMENTS AND RATIOS

	Group I	Group II	Group III	Group IV	Group V	Group VI*	Group VII*	Group VIII*	Group IX*
<i>Length (mm.)</i>									
Male	62†	88	115	130	133	135	136	136	136
Female		80	92	105	107	109	110	110	110
<i>Breadth (mm.) distal end</i>									
Male	13†	17.5	20	22	22	22	22	22	22
Female		16	17	18	18	18	18	18	18
<i>Breadth (mm.) shaft</i>									
Male	4.5†	6.1	7.0	7.6	7.9	7.9	8.1	8.3	8.6
Female		5.3	5.9	6.5	6.6	6.6	6.8	6.9	7.0
<i>Ratio (%) breadth</i>									
distal end to length	20.5	19.5	18.0	16.9	16.6	16.4	16.3	16.3	16.3
<i>Ratio (%) breadth</i>									
shaft to length	7.5	6.9	6.1	6.0	6.0	6.0	6.0	6.1	6.3

*Length and ratios adjusted to younger groups by subtraction of 5 mm. (height of tarsal cap) from measurement of length in each specimen in this group.

†Both sexes.

average 5 mm. in height, this amount has been subtracted from the total linear measurement in each specimen of the groups noted. This makes possible a comparison of growth and development throughout the entire series.

From the table and graphs, it appears that the distal dimension is first to attain full size (Group IV), though, relatively, the distal end is progressively smaller up to Group VII, at which stage the maximum length of the bone is reached. The shaft continues to broaden up to adulthood; however, as linear growth proceeds more rapidly than transverse development in the earliest stages, the shaft is relatively narrower through successive groups to Group IV. Growth of shaft and length are then apparently proportional until after linear growth ceases, when the continued enlargement of the shaft results in a proportionately greater transverse dimension.

CONCLUSIONS

The following observations have resulted from study of the series of turkey tarsometatarsi just described.

Though the very youngest chicks have a semblance of the general shape of the adult bone, contours are undeveloped, and the bone is extremely porous.

The shaft straightens as the contours of the distal end begin to take shape (Groups II and III). A slight indication of size difference due to sex becomes apparent in Group II and is more clearly discernible in Group III.

Full breadth of distal end is apparently reached by the time the internal foramen is completely outlined, although the external foramen is still open (Group IV).

The indefinitely rounded proximal tips of the metatarsals flatten out and become less porous before uniting with the tarsal cap (Group V). Formation of the distal foramina is completed by this stage.

Separate tarsal elements have not been discovered in the Rancho La Brea material. As observed at the time of beginning of union with the metatarsals (Group VI), they are fully formed, though porous at the edge of contact with the metatarsals. At this time the tarsal section is in one piece which forms the proximal cap bearing the articular cotylae of the tarsometatarsus, and posteriorly fits over the middle metatarsal to form the hypotarsus, through and over which pass the tendons of the flexor muscles of the foot.

Linear growth continues until the tarsus and metatarsals are completely united (Group VII). At this time the length apparently becomes fixed, even though the texture of the bone is still slightly rough.

As the tarsal cap appears to have completed its proximal ossification before union with the metatarsals, the transverse dimension of the proximal end should be fixed at this time. It could be slightly altered, however, by the growth of the small muscle attachment on the outer side which, in many specimens, is found to merge with the lip of the external cotyla. Although many of the subadult specimens, in which the tarsus has united with the metatarsals, are considerably worn just below the lip of the cotyla, a comparison of those which can be accurately measured, with adult specimens, justifies this assumption.

The bony lamina which extends downward from the internal process of the hypotarsus becomes well developed before the appearance of the spur core (Plate 25, lower figure, *a*). It appears to remain loosely attached to the main shaft of the metatarsals, however, until after the spur core has begun to form. The shaft, itself, maintains a roughness and porosity in its mid-posterior section which would suggest that the core originates and grows from the metatarsals. This idea is refuted, however, by specimens in which the core is undergoing development (Plate 25, lower figure, *b* and *c*) which show the core fully attached to the bony lamina, but both lamina and core separated from the metatarsal shaft. The growth of the core appears to be entirely from the

EXPLANATION OF PLATE XX

Parapavo californicus.—(Upper figure) Series of young metatarsi, illustrating growth stages in the first seven groups: *a*, one of the youngest available specimens, Group I; *b*, a larger (presumably older) specimen from Group I; *c*, Group II; *d*, Group III; *e*, Group IV; *f*, Group V; *g*, Group VI; *h*, Group VII. About 0.30 X.

(Lower figure) Series of tarsometatarsi, showing development of spur core. Conditions illustrated: *a*, complete lamina with slight proliferation of cells present at its distal tip; *b*, nubbin of spur core; *c*, more advanced nubbin; *d*, core well united with shaft; *e*, full-grown spur core. About 0.32 X.

internal side of the lamina, the external surface of which remains smooth. In one specimen, the lamina appears to be made up of two separate, thin layers, only the inner of which takes part in core development. With the continued growth of the core, core and lamina attach to the metatarsal shaft, evidently aided by a proliferation of cells from the rough area on the shaft of the metatarsals (Plate 25, lower figure, *d* and *e*).

Although the breadth of the shaft in the adult bones may be partially affected by this activity in the area of the developing spur core, the shaft as a whole maintains a slight porosity in both male and female bones until the ridges and grooves formed by the tendons are fully etched on its surface. As long, therefore, as roughness or graininess in texture of bone exists, slight increase in breadth of shaft may be expected, though the linear dimension is apparently not altered once the tarsal and metatarsal elements are well united.

This concept of the proportions of the bones of immature individuals is of importance in paleontological studies. Lacking true epiphyses, the time of cessation of growth in avian specimens is not clearly marked as in mammalian bones. It appears, however, that in the tarsometatarsus, in which the tarsal element acts as an epiphysis, it is safe to consider linear measurements on a par with those of adult individuals when the fusion of the two parts is complete, though the proportion of breadth of shaft would be unreliable as long as roughness exists.

Los Angeles County Museum
May 1, 1945

BEHAVIOR OF BIRDS DURING A FLORIDA HURRICANE

BY GEORGE MIKSCH SUTTON

ON October 19, 1944, a much publicized hurricane, which moved northward from Cuba by way of Tampa, struck the vicinity of Orlando, Orange County, Florida. Hundreds of large trees were blown down in Orlando and in the neighboring town of Winter Park, just to the north, but destruction of houses was not great on the whole; damage to the citrus crop appeared to many eye-witnesses to be considerably overstated in the newspapers, and very few lives were lost. At the 'New Area' of the Army Air Forces Tactical Center, at which base I was stationed at the time, scores of large pine trees were broken off or uprooted, several wooden barracks were shoved from their cement-block foundations, and roofing paper, tin chimneys, and wooden ventilators were blown off right and left.

We had received numerous warnings concerning the approaching storm, so were not taken by surprise. An east wind was blowing hard when I wakened at 7 o'clock on the morning of the 19th, and it was raining. I rose and dressed, made my way to the office building at which I regularly reported, found the door to be not only locked but boarded shut, and returned to my barracks, wringing wet. The telephone was in order, so I called the officers' cafeteria to inquire about meals. A tense voice answered that no food was being served, that the building there was expected 'to go' at any moment. My own barrack was of solid, cement-block construction, so I did not expect it to blow down; but the thrashing of the pines, the wild gusts and screeching wires, the whirling, tumbling clouds, and the great batlike sheets of roofing paper which whipped off and blew about were so exciting that I chose to stay outdoors in the lee of the building, watching the storm.

By 9 o'clock the wind had shifted to the southeast. Lake Suzanne, a small body of water whose north shore was only a few rods south of my barracks, I now could see but dimly through the rain and spray from the lashing waves. The trees along the open shore bent in the fierce blast, some snapping off noisily, others sinking slowly to the ground as their roots gave way. Some of the worst gusts came at about this time, so most of the trees which I saw go down fell toward the northwest. By 10 o'clock the wind had swung round to the south. The storm's fury abated somewhat toward noon, at which hour some of my fellow officers and I went in search of food. A strong west wind rose between 2 and 2:30 P. M., continuing to blow for about two hours. By 5 o'clock the storm had passed, the sun had come out, and we looked upon a thoroughly drenched and rather battered world. The wind's velocity, as recorded by the local weather stations, had been about 78 miles per hour, with gusts up to 108 miles per hour. The strongest gusts had occurred between 8 and 9:30 A. M., and in mid-afternoon.

What of the bird-life during all this? As for the several Mockingbirds (*Mimus polyglottos*), Blue Jays (*Cyanocitta cristata*), and Shrikes (*Lanius ludovicianus*) which lived near the barracks, I saw many of them during the height of the storm. One mocker dived from thrashing shrubbery under a low porch close by and ran for shelter behind one of the supports. A shrike which had found a comfortable perch in a small oak—a nook behind a clump of Spanish moss—whipped back and forth with the treetop until the slender trunk snapped, then flew to the lee of an outhouse where it stayed on the ground close to the foundation for an hour. Three Blue Jays moved about among

the swinging pine boughs almost as if they were enjoying it all, but I noticed that they sought the shelter afforded by the trunk now and then, and that when they flew from tree to tree they invariably made their way by diving into the wind from the upper part of one to the lower branches of the next.

For a time I failed to discover the Palm Warblers (*Dendroica palmarum*), which usually were so much in evidence all over the Area. Eventually I found them—under porches and thick shrubbery, behind and under ventilators on the buildings' roofs, and in the grass a short way back from the lake-shore. They did not fly about while the wind was high, and those which I was able to observe did not seem to be in the least interested in feeding. The only bird which I found dead directly after the storm was of this species. I found it along the southwest shore of Lake Corinne, another body of water within the 'New Area.'

At about 9 o'clock I saw an Osprey (*Pandion haliaetus*) high in air directly overhead, moving swiftly northward, apparently quite unable to control its course. It was headed east, southeast and south as long as I could see it, and it seemed to be trying to fly into or across the wind. When it finally disappeared into the cloudy sky it was still headed southward, but moving rapidly northward. I could not help wondering how far it might be carried thus and, remembering the species' well nigh cosmopolitan distribution, wondered how often wind might have been the means of carrying it from one land-mass to another.

An Egret (*Casmerodius albus*) which flew across Lake Suzanne at about 11 A. M., just after some of the fiercest gusts, had a very difficult time. Twice I thought the bird was going to give up and fall into the waves. A Little Blue Heron (*Florida caerulea*) which found shelter back of some weeds along the north shore of Lake Suzanne, stood there hunched up, with bill pointed into the wind, for more than three hours—perhaps longer. Three Killdeers (*Charadrius vociferus*) stayed back of the same clump of weeds during most of the storm.

A Flicker (*Colaptes auratus*) which flew out from a falling pine, started off down-wind, struck the ground, righted itself, about-faced, and started again upwind, finally reaching the shelter of another pine trunk. Here it remained virtually motionless, as if dazed, for an hour, then climbed to a better shelter under a bough.

A Red-headed Woodpecker (*Melanerpes erythrocephalus*) which had been roosting regularly in an old woodpecker hole in a dead stub not far from my office window, probably did not emerge at all during the storm. At noon, when I passed its stub for the second time, it was looking forth dubiously.

Species which lived about the barracks but which I did not see until late afternoon after the passing of the storm, were the Cardinal (*Richmondena cardinalis*), Ground Dove (*Columigallina passerina*), and Red-bellied Woodpecker (*Centurus carolinus*). A species which we had been seeing daily as it passed over, but which was nowhere to be seen on the 19th, was the Fish Crow (*Corvus ossifragus*).

Several Ring-billed Gulls (*Larus delawarensis*) and about 15 Common Terns (*Sterna hirundo*) were blown in by the storm. The latter lingered about Lake Corinne for three days. On the day after the hurricane I almost captured one of these terns which probably had been badly buffeted by the wind. The gulls stayed about for some time.

Word reached us that a Caracara (*Polyborus cheriway*) had been picked up dazed in the streets of Titusville, Brevard County, Florida, thirty some miles to the east of Orlando.

In general, I was surprised at the birds' ability to adjust themselves so quickly to the conditions imposed by the storm. A good many birds might even have remained in their roosting places (as did the Red-headed Woodpecker) during most of the day. Certainly not many birds attempted to feed, though the Blue Jays appeared to be doing so. The one dead bird which I found on October 20 (Palm Warbler) may or may not have been a victim of the storm.

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A COMPARISON OF THE SUMMER RESIDENT BIRDS TODAY AND FORTY YEARS AGO IN A SMALL AREA IN MASSACHUSETTS

BY STANLEY COBB, M.D.

IN the winter of 1943 I chanced to glance over some of my old ornithological notebooks and realized that perhaps I had something of value. Here, for the years 1903 and 1904, were very full notes on the birds seen in Milton, Massachusetts. I still live on the same land, so I planned to make a survey in the spring and see how the avifauna compared in 1943 with 1903. The week of May 30 to June 6 was chosen as the best time to study resident birds, and the survey was repeated in 1944. Birds that were seen three or more times on the land chosen during those weeks were counted as resident; in a few instances nests were found. The scoring was done in pairs, a male and a female counting as one unit, so on the chart the number in parentheses after the bird's name means the number of pairs, not number of

individuals. Birds were considered "common" and were therefore counted if two or more pairs were resident in the area. Many less common birds were represented by one pair only, but it was thought that because of the many possible errors in the method of observation and the ambiguity of some of the old notes, it was wiser to study only the common resident birds about which there could be no doubt. This method certainly cannot be considered accurately quantitative, but I believe it gives a close enough approximation to the truth to be valuable in a field where good quantitative data are scarce.

The area studied is a little less than one-third of a mile square, about 75 acres. It lies on the eastern part of Milton Hill, and is bounded along the southern side by a main road and on the north by a salt marsh. About half the land is on the rounded top of the hill; the other half is a slope to the north, overlooking the estuary of the Neponset River. The northern half of the land is wood-lot and partly overgrown pasture. The trees are mostly hardwoods, maple, beech, oak, birch and a few white pines. In the pasture are many cedars and scattered hemlocks and pines, with oaks occasionally and sumachs and brush along the stone walls. The hill is a terminal moraine rising 50 to 80 feet above the tidewater. Along its top and south side (in this area in 1904) were eight residential houses and about an equal number of barns. Five new houses have been built in the forty years, but two old ones have been torn down. So the land remains remarkably similar to its state in 1904. Around these houses are small lawns, fields of an acre or two, flower gardens and truck gardens, with many large shade trees, elms, oaks, beech, white pines, spruce and hemlock. There are several small orchards near the houses of five to ten apple, cherry and pear trees.

The data are presented in the chart. On the left is a list of 26 common birds that had two or more pairs resident in this area in 1903 and 1904; on the right is a list of the 24 common birds represented by two pairs in 1943 and 1944. The commonest birds are listed at the top (e. g., House Sparrow, ten pairs in 1904, and Robin, 6 pairs in 1944). When a bird appears on both lists, a line is drawn from its position in one column to that in the other column. If the line descends from left to right it indicates that the bird has become less common in forty years. If the line ascends from left to right it indicates an increase in numbers. A glance at the chart shows that fifteen birds have decreased, ten have held their own, and seven have increased in numbers, only four of these significantly. Nine birds in the 1904 list are not on the 1944 list at all, and three birds on the 1944 list do not appear in 1904; these are the Starling and Ring-necked Pheasant

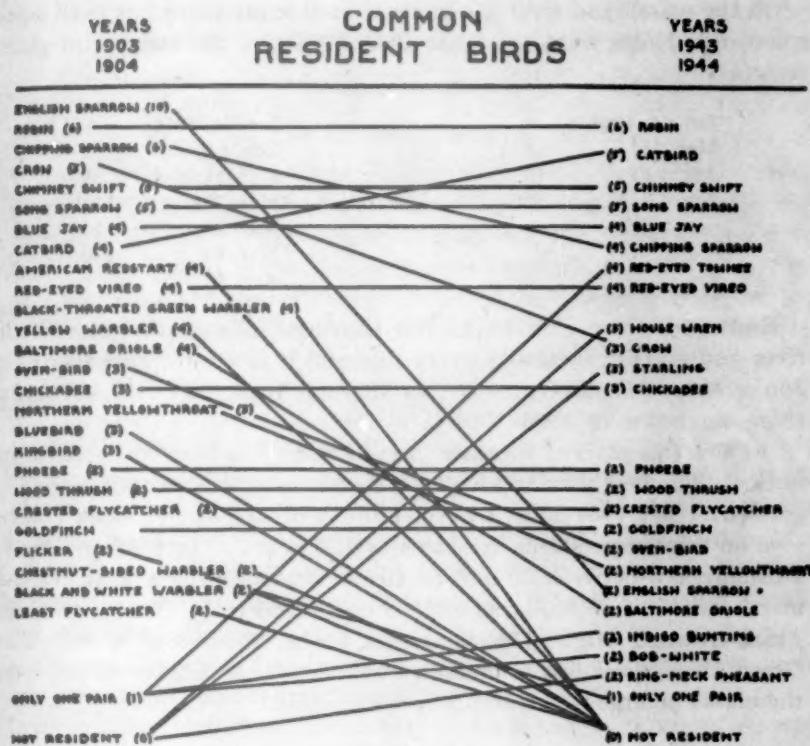
(both introduced) and the House Wren which is well known to have spread its range northward during these years. The other bird that has shown a marked increase is the Towhee. In 1904 these birds were not often found breeding on Milton Hill although they were common in the rough scrub-oak country of the Blue Hills only five miles to the south. Now they seem to be more abundant everywhere and have spread into areas not typical of their former habitat. In fact, I think the Towhee may now be the commonest bird in Massachusetts, even outnumbering the Robin.

Of the birds that have decreased, the most striking is the House Sparrow. In 1903-1904 they infested every barn; now a few were found around one stable. This is probably due to the replacement of horses by automobiles and the resulting decline in oats and horse manure. The other birds that have shown a marked decrease are the Redstart, Black-throated Green Warbler, Yellow Warbler, Bluebird, Kingbird, Chestnut-sided Warbler, Black and White Warbler and Least Flycatcher. In 1903-1904 these were regular residents in the fruit trees and shrubs. Finding their nests was easy and these birds made the gardens lively. Now they are absent; they are seen in migration in moderate numbers but they do not populate this area as they used to do. The land, trees and shrubs are much the same as forty years ago. Cats are only slightly more common. What, then, has caused this great decrease? One factor that is new since 1904 is the regular spraying of fruit trees, shade trees and some shrubs. The possibility that this has destroyed the birds' food and also poisoned many birds is to be considered. At least it can be said that six of the eight birds in this group were our common orchard dwellers in 1904.

Two other birds that have decreased are the Chipping Sparrow and the Crow. The latter seems to be just as common in winter, but fewer of them nest in the area, perhaps because so many of their favorite trees—the white pines—were destroyed by the hurricane in 1938. The Chipping Sparrows are still common, but not as abundant as formerly. This I believe to be a recent falling off in the last five years, at its lowest in 1942 and already improving. No explanation suggests itself. The moderate decrease in the Baltimore Orioles may be like that of the orchard birds, but less marked.

Birds that have shown a moderate increase are the Catbird, Bobwhite and Indigo Bunting. Those that have held their own make a list of stalwarts: Robin, Chimney Swift, Song Sparrow, Blue Jay, Red-eyed Vireo, Chickadee, Phoebe, Wood Thrush, Crested Flycatcher and Goldfinch.

The salt-marsh to the north of the area surveyed is an interesting



TEXT-FIGURE 1.—The chart consists of two lists of birds: on the left are those species of which two or more pairs were resident in the area studied in the breeding seasons of 1903 and 1904. The number in parentheses after the birds' names indicates the estimated number of pairs breeding in the area. The list on the right is of those birds two or more pairs of which bred in the area in 1943 and 1944. When a species appears in both columns the names are joined with a line. Since the species are arranged in order of abundance from the top down, a horizontal line indicates that the abundance of that species has remained unchanged. A line falling from left to right shows a decrease from 1904 to 1944, a line rising from left to right show an increase in that species during the forty years.

stretch of land bordering the tidal Neponset River. It covers more than a square mile and I could not properly observe the birds on it in the time allotted. A few facts were obvious: Bobolinks that in 1903-1904 were noted as "several" and "common" about the fields bordering the marsh are now rarely seen. This is probably due, at least in part, to the cutting up of the big fields into house lots. In fact one might ask if all the changes in fauna were not caused by the change of the region from rural to suburban. This is quite true of the land to the east and west of the area under consideration, but the area itself has changed hardly at all.

On the marsh and river the increase in Herring Gulls has been conspicuous. Notes from the years 1903-1904 give the number of gulls seen as:

Jan. 16, 1903	9	Jan. 31, 1904	3
Mar. 25	6	Feb. 1	1
Apr. 1	110	Mar. 11	20
Apr. 13	30	Mar. 20	150
		Mar. 25	50
		Mar. 26	100
		Apr. 11	4

Nowadays there are 100 to 200 Herring Gulls on this stretch of river and marsh practically every day and it is not unusual to count 300 or 400. Moreover, many stay through June, July and August, a thing unknown in 1903-1904.

Besides this marked increase in gulls there has been an increase in ducks. The best time to see ducks here is in March just after the ice goes out. My 1904 notes give the number of Red-legged Black Ducks seen on three expeditions in March as 4, 4, and 7. In 1943 and 1944, I usually saw between 30 and 50 Black Ducks during a walk by the marsh, with a few Mallards and an occasional teal. The number of Black-crowned Night Herons seems to be about the same. The Green Herons are less abundant. Starlings occasionally descend on the marsh in large flocks, but they are irregular.

SUMMARY

Field notes made by me in 1903 and 1904 as compared with notes made in the same area in 1943 and 1944 on birds resident in early June show that the Red-eyed Towhee, the House Wren, the Starling and the Ring-necked Pheasant have increased in numbers (the last two, being imported species, have increased from 0). The species that have shown a marked decline in numbers are the House Sparrow, American Redstart, Black-throated Green Warbler, Yellow Warbler, Chestnut-sided Warbler, Black and White Warbler, Bluebird, Kingbird and Least Flycatcher.

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MAIN ARTERIES IN THE NECK AND THORAX OF
ORIOLUS CHINENSIS DIFFUSUS SHARPE

BY FRED H. GLENNY

INTRODUCTION

As in other passerine birds, *Oriolus* is typically "aves laevo-carotinae." A single specimen of *Oriolus chinensis diffusus* Sharpe was available for study. This material was sent to the writer by Professor Tsen-Hwang Shaw, Fan Memorial Institute of Biology, in 1940, and was collected near Peiping, China. The following observations are based, therefore, upon the arrangement of the arteries in the neck and thorax of but one specimen.

OBSERVATIONS

The systemic (right 4th aortic) arch (3) arises from the base of the right innominate artery (2) and joins the right radix aortae (4) which passes posteriorly to join the dorsal aorta (8). At this point, the ligamentum aortae (5) has its distal attachment. The ligamentum aortae is prominent in the adult bird, and maintains its proximal attachment to the pulmonary artery (6). The ligamentum botalli remains as a ligamentous 'button' (7) on the ventral face of the right radix aortae near its base; the rest of the ligament atrophies or fuses with the fascia surrounding the radix.

Anteriorly the innominate divides to form the subclavian (10) and common carotid (9) arteries which then send off several branches.

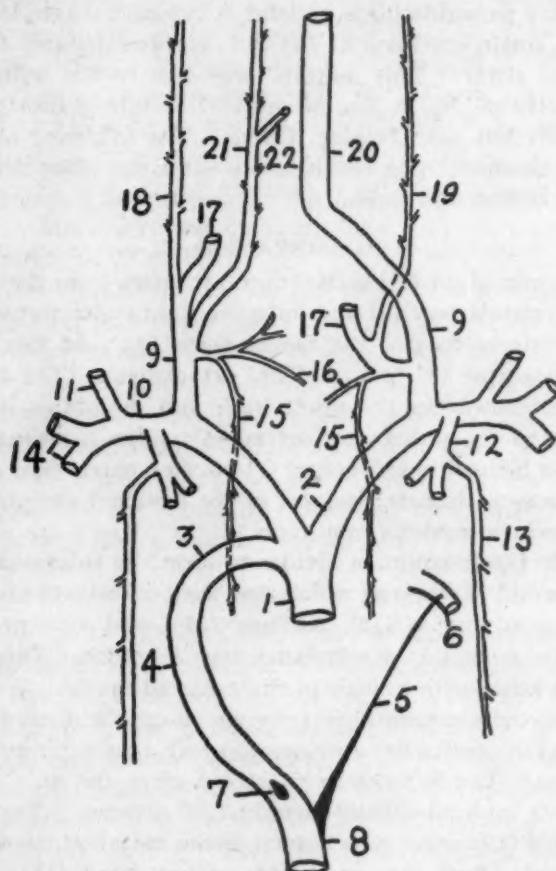
The coracoid major (12), axillary (11), and two pectoral (14) arteries arise from the subclavian artery in order. The intercostal artery (13) arises as a branch of the coracoid major.

The right common carotid artery gives rise to the ductus shawi (15), vertebral (17), and ascending-oesophageal (right internal carotid) (21) arteries. The left common carotid gives rise to the vertebral (17) and left internal carotid (trunk) (20) arteries. The left superficial cervical (19) arises as a branch of the vertebral, as does the left ductus shawi. Both left and right ductus shawi (15) give rise to syringo-tracheal branches (16). The right superficial cervical artery (18) arises from the right vertebral near its origin. A single vessel *arteria furcula-collis ventralis* (22) arises from the ascending-oesophageal artery (21) and supplies the tissues in the region of the furcula and at the base of the neck.

DISCUSSION

The significance of the arrangement of the arteries in *Oriolus* cannot be determined at the present time. Only after a larger series of dis-

sections on other species has been completed and comparisons made can we draw anyway near satisfactory conclusions with regard to the significance of the present findings. The present information may serve merely as a guide to further studies on other members of this family of birds.



TEXT-FIGURE 1.—Main arteries in the region of the neck and thorax of *Oriolus chinensis diffusus*; ventral view.

KEY TO ABBREVIATIONS

- 1, aortic root; 2, innominate arteries; 3, right systemic arch; 4, right radix aortae; 5, ligamentum aortae; 6, pulmonary artery; 7, ligamentum botalli (button); 8, dorsal aorta; 9, common carotid artery; 10, subclavian artery; 11, axillary artery; 12, coracoid major artery; 13, intercostal artery; 14, pectoral arteries; 15, ductus shawi; 16, syringo-tracheal artery; 17, vertebral artery; 18, right superficial cervical artery; 19, left superficial cervical artery; 20, left internal carotid (trunk) artery; 21, ascended oesophageal (right internal carotid) artery; 22, arteria furcula-collis ventralis.

Akron,
Ohio

REPORT OF THE A. O. U. COMMITTEE ON BIRD PROTECTION FOR 1944

LAND is the source of all material wealth, of the food we eat and the materials from which our shelters are made; most naturalists and all economists understand this important fact. It is not so generally recognized how important the landscape and various elements in it may be in maintaining a healthy condition, both physical and mental, among people. Whether we look upon land solely as a producer of crops to be harvested, sold, and then used, or think of land as producing plants, animals, and scenery, to be used without destruction or removal, determines the kind of response we make to the idea of bird protection.

Members of the American Ornithologists' Union have taken a lead in the protection of birds in accordance with both these options in the scale of attitudes toward natural resources. Approach to the problems which arise involves many contradictions both in manner of thinking and in execution of decisions. Your Committee believes that this is an opportune time to study the problem and to enquire into possibilities for defining the kind of bird protection program best adapted to the knowledge and views of the Union.

Wartime obviously affects adversely the land and the peoples of our countries even though they may be far from the scene of conflict. These influences are important because, coming so quickly, we have no time to prepare for them; they stop, or hasten, or reverse, tendencies to which over long periods we have become accustomed; they extend farther than we are likely to realize, and they establish precedents, both good and bad, that may govern our behavior for a long time in the future. Therefore, if we are to encourage the good trends and counter the bad ones, we should recognize them early and prepare ourselves to help or to hinder them.

The ornithologist thinks of bird protection in a manner different from those whose chief interests lie in some other direction even though this be closely related. As examples: farmers, hunters, fishermen, or park rangers may consider birds as a help or a hindrance in their affairs and respond to the condition accordingly. A farmer may be one who wants no bird protected that takes any part of his crop, though he may consider some species beneficial because they eat seeds, or insects, or rodents, and he may encourage the presence of others because he likes to see them. A hunter may want shootable birds protected until he is ready to kill them, and, too often, he considers all other species as vermin. Fishermen tend to magnify the extent

to which fish-eating birds feed upon game fishes and to call for their destruction, themselves to undertake the killing. A park ranger may be one who wants to protect all birds conspicuous enough to show visitors.

An ornithologist wishes to preserve a representation of every native kind of bird, in numbers adequate to maintain the species. He wants no greater population of each kind than the available habitat will support, but he may advocate some artificial adjustment of the environment to accommodate a minimum population. His objective is a kind of conservation which assumes that land comes first and that its proper use must be the basis of all conservation. When this has been attained, enough people may desire the preservation of animals and plants to see that it is accomplished.

Meanwhile, we must be concerned with such immediate problems as overpopulation and underpopulation of birds. The first of these comes when we intentionally, or by accident, change the environment in such a way that a species, or a set of species, increases or assembles beyond normal numbers. Fields which resemble some natural habitat, but which contain even more food, attract great numbers of birds and this condition results in complaints of damage or threat of retaliation by people. Such problems generally have been localized, but some, involving birds like crows and blackbirds, concern great areas and cause strong prejudice against birds in general.

Among the current explanations for small numbers of some kinds of birds we should consider the following.

Predators are blamed on slight evidence, or none, by many people as being responsible for small numbers of birds. It has become increasingly apparent to us that predators generally are fitted to get their food without taking a proportion of any animal so great as to endanger its existence.

Parasites and disease, too, are little understood as determiners of populations. It seems clear, however, that these are normally of small import in reduction of species under naturally wild conditions.

Scarcity of food may limit the presence or numbers of a species, but again such occasions come rarely in the wild. Food is available in amount sufficient to keep the native species alive within their normal ranges where the land has not been artificially modified.

When we come to consider human activities, it is easy to discover how birds are hindered to the extent of approaching extinction in some species or helped to the stage of becoming injuriously numerous in others. First, we face the accusation, unjustified but often heard, that some birds are injured to the point of extinction by the actions of

students—A. O. U. members. Rare birds have a special attraction for photographers, falconers, banders, and collectors. It is now well known how each of the interests represented may harm the species concerned. The discipline imposed by the Union and other ornithological societies on their members has served to keep these pursuits within proper bounds although this has not been effective in every instance. It is fitting that control in this manner be maintained by education and the force of group opinion, rather than by administrators of game who use legal action and tend to favor too severe regulations. Moreover, it is necessary that study of birds by scientific methods be continued. It is especially important that any person undertaking serious study of birds be able to build his experience on the handling of objects—specimens which he finds, takes, examines, and preserves with his own hands. A worthy aim of the Union would be to promote the opportunity for all ornithologists to do collecting as a part of their study, unhampered by unnecessary restrictions.

Activities of people other than students are those which really decimate bird species. It may be natural to look beyond these for some new or unknown factor which causes the harm. However, it has now become well established, though possibly not yet widely acknowledged, that the chief problem in maintaining bird species is the control of people. This is less a problem of new and strict laws than it is of demonstrating the ill effects of irresponsible shooting, of bad farming, and the misuse of land generally. A widespread recognition of these evils is essential.

The pleasure to be obtained from hunting as practiced under natural conditions is not found by the modern army of shooters that travels by motor and is equipped with new and untried outfits. However, the sport, or the anticipation of sport, is enough to bring shooters in increasing numbers to the woods and fields each season. It is becoming evident in many places that shooters are far too numerous or too few to keep the harvest of game birds adjusted to production, whether on managed or unmanaged lands. The problems for which they are responsible are mainly outside the scope of A. O. U. concern except when species are brought to the point of extinction through overhunting, or when attitudes develop that consider birds, except game, as nuisances.

Farming varies greatly in its effects on the native avifauna. The types which leave the natural vegetation least modified change least the kinds of birds and their numbers. The kinds which use the whole surface of the land for crops leave little or no room for a permanent bird population. Fortunately only a minute portion of the land can

be so treated. The remainder is farmed most profitably by practices which employ natural principles involving maintenance of organic soils and adequate moisture, and which recognize a place for some animals and some species of plants in addition to those forming the main crop. Sometimes these are harvested to supplement the planted crop. Changes in bird numbers resulting from farming are mainly the concern of the land owner and usually they do not enter the problem of protecting species of birds. Exceptions occur when such species as the Prairie Chicken are brought nearly to extinction by unfavorable agricultural practices.

Other uses of land involving such practices as forest-cutting, drainage, control of stream beds, road construction, making of parks, brush burning, and many types of management for game show a common tendency to impose a regularity of landscape. This may increase the number of birds of some kinds or the total of individuals, or it may bring a depletion, but it is also likely to destroy the variety of habitat required for the normal community of living things. The interspersion of environmental types frequently sought establishes a certain type of irregularity designed to support more animals on certain areas. The control of the land may bring the desired result temporarily or even permanently. The main injury here is that which results from a partial control practiced without consideration of the resulting disturbances in other parts of the environment. Persons who thus disturb the land may have an obligation to compensate for the changes they intend to initiate.

It may be true that too little is known about the processes involved to permit evaluation of the human activities which interfere with nature. Possibly it is better to say that too few people know the conclusions that are becoming accepted generally by naturalists. The problems of bird protection which confront the A. O. U. would become clearer if all members could study the publications of the last decade concerning the interrelations among plants, animals, and the land of our continent. Coming to an agreement on the primary aims to be sought, and the most likely profitable ways of reaching them, would make our efforts more effective than would a continued attempt to meet each of the examples of bad natural history as it appears. These have now become so numerous, so extensive, and so widespread as to be far beyond the powers of our organization to keep acquainted with them, let alone to cope with them.

The great, recent extension of agricultural practice to include management of wild land and its plant and animal inhabitants involves an attempted control over large areas previously not molested. The

resulting increases in bird populations have been demonstrated clearly, though it is not yet clear that stable, varied, natural populations can maintain themselves on such land. Along with these movements to increase birds there has developed a correspondingly great and effective capacity to destroy them and their homes. Continual compromise has permitted growth of the two notions by postponement of the final decision to preserve samples of all the kinds of birds and their natural habitat. It is evident now that the home of any species will be destroyed if it contains some element of considerable salable value. Purchase of the lands by federal, state, or provincial governments may remove them only temporarily from the market.

The human activities likely to be opposed by a naturalist who typifies the interests of our organization include the following:

1. Modification of natural, or near natural, areas in efforts to improve their wilderness values or to make money.
2. Designation of areas as preserve, wilderness, or sanctuary when artificial tampering with the biota or environment on them is undertaken.
3. Regulation by poison of mammal populations on wild land and bird populations anywhere.
4. Transfer of wild animals to localities outside the normal range of the geographic race represented.
5. Release of exotic species to substitute for native species depleted in number or considered inferior by hunters.

It is likely that this naturalist will observe, without taking a prominent part in, such activities as the following which come properly within the scope of wildlife management:

1. Establishment and development of protected areas to provide more game and fish for hunters.
2. Practices of modifying farming, lumbering, or recreational custom in order to increase or decrease birds or other kinds of animals.
3. Modification of hunting regulations calculated to keep a supply of birds available for all licensed hunters, so long as these regulations do not threaten the existence of any species.

His energies will be used to promote those activities which come naturally from his primary interest in birds, such as:

1. More vigorous attempts among naturalists and other persons to understand the significance of wild plants and animals, including birds, on the land.
2. Continuous agitation for the designation, the protection, and immediate study of tracts of land to be preserved as adequate samples of original conditions represented on the continent. Where no ade-

quate representation of a wilderness type is available, substitutes may be selected from lands little modified and these treated so as to permit recovery. On these tracts the valid aim would be to protect the environment, not to maintain it.

3. Search for better information, obviously needed in connection with species approaching extinction, to show a possible working plan of preservation and one that would permit vigorous prosecution of the plan. So far no one has been able to resolve satisfactorily the clash of interests which comes when some commercial undertaking takes away the living place of a species. The upper limit of public money that can be used to buy a home for a kind of animal or plant has not been determined. However, where such trees as the redwood and the Monterey cypress have been concerned, relatively huge sums were spent for this purpose. This question, apparently, is the major obstacle now preventing favorable action in behalf of the Ivory-billed Woodpecker.

The 1943 report, published late in 1944, makes use of current information concerning threatened species. It invites every member to make the results of recent observations available. One handicap to the prompt use of pertinent observations is the long time required to assemble information from many parts of the continent. A possible remedy for this delay would be to make use of the organization which reports on the status of birds in the Season section of Audubon Magazine. Sending information on rare species to the compilers of the regional reports would help them and would make the information available quickly to this Committee as well as to other interested persons.

If this Committee is to represent adequately the membership of the A. O. U., it must be supplied with information from, and the opinions of, the individual members. It may indicate opportunities for enquiry and action, but the effective interest must come from the remainder of the organization. If only a few members are actively concerned about the preservation of birds, we may conclude that permanent success must be dependent on the incidental results arising from the movements to culture birds mainly for economic motives. There is no doubt that land birds will be helped by improved practices of culture of the soil and that both land birds and aquatic birds are helped by wiser control of streams, lakes, marshes, and swamps. However, these practices alone will not preserve the natural samples of habitat and the sets of plants and animals which go with them. This latter we believe is actually the real aim of the A. O. U. in its desire to protect birds. True understanding of birds and their rôle in the biota will come from study of them in these natural situations.

Recognition of the need for this normal representation of our avifauna does not prevent the development of museums, zoos, game refuges, or managed wild areas, but rather it gives better perspective to our efforts in defining, selecting, and regulating these developments. We need to discover the fact that we are not yet prepared to control natural processes. The place to make this discovery is the area where protection rather than regulation is the practice. It is clear that most of the land is not now in condition to maintain the natural processes without special attention to it at first, and that the kind of attention required varies from place to place. The desirable aim, however, is to practice the minimum of disturbance required to re-establish the normal relations between the land and its inhabitants.

In suggesting that the Union define its interest in bird protection we feel that its influence could thereby become more effective and its special knowledge would supplement, rather than follow or duplicate, the work of other organizations whose aims overlap ours in part. In addition to recognition of the individual responsibility for understanding the problem, each member can serve to maintain bird species directly by acquainting himself with persons in his vicinity who work with wild birds. These include game wardens, forest rangers, museum curators, park wardens, trappers, vermin hunters, and nature writers or lecturers. Especially to be sought is acquaintance with the organization which administers natural resources in each State or Province.

If the anticipated changes in treatment of land are carried out after the war, there may be urgent need for the kind of advice that members of the A. O. U. are equipped to give. It is not too early for them to review their evidence and opinions bearing on these matters. When structures have been made on, and control of vegetation or animals attempted over, some of the special kinds of habitats which still support remnants of declining bird species, it may be too late to protest or to suggest. Americans are learning to modify landscapes on a scale not previously imagined and before long they may practice these skills on lands hitherto considered safe for birds.

JEAN M. LINDSAY, *Chairman*

PAUL L. ERRINGTON

J. A. MUNRO

GENERAL NOTES

The Black Duck nesting on the outer coastal islands of Maine.¹—(Plate 26)

—In recent years the Black Duck (*Anas rubripes*) has been found breeding in increasing numbers on small islands located well out to sea along the coast of Maine. Many of these islands are without fresh-water pools and ponds which we are accustomed to associate with the nesting environment of the Black Duck. This bird, typical of the inland lakes and marshes, keeps strange company on these outer rocky islands where the only other inhabitants are the sea birds such as the gulls, guillemots, cormorants and eiders.

The nesting of the Black Duck on these islands is not always limited to isolated cases; for example, on June 2, 1944, on No Man's Land, a member of the Metinicus group of islands lying 15 miles out to sea from the mainland, we found two broods and also six nests with eggs of the Black Duck. This represents an unusual concentration for a bird which usually nests in inland places often remote from others of its kind.

The following nesting records were incidentally made while I was visiting the Herring Gull colonies along the Maine coast with representatives of the U. S. Fish and Wildlife Service for the purpose of conducting a control of this gull. The islands are arranged in order, beginning with those along the southwesternmost and continuing to those situated along the northeastern part of the coast. To assist the reader in finding the islands on a map, the approximate latitude and longitude are given.

Eagle Island. 43° 28.8' N., 70° 21.6' W.

On May 23, 1944, a nest containing nine eggs was found in a thick mass of grass and red-raspberry bushes growing in a narrow depression of this rocky island. There are no springs or fresh water pools of any kind on this island. The nest was situated about 50 feet inland from the high-tide mark of the shore. One of the eggs examined contained an embryo of about 15-days incubation.

Stratton Island. 43° 30.3' N., 70° 18.8' W.

There is an unoccupied dwelling on this island surrounded by a number of trees and shrubs. Much of the surface of this ten-acre island is covered with a luxuriant growth of grass, and near its center is a fresh-water pond bordered with cattails and tall marsh grass. On May 23, 1943, several Black Ducks were flushed from the pond, but no nests were located at that time. On May 23, 1944, we saw 12 Black Ducks with as many Blue-winged Teals on the pond. In the tall marsh grass about 20 feet from the edge of the pond was a Black Duck's nest with nine eggs. The embryo in one egg opened was about ten days old. I am confident that several pairs are breeding on Stratton Island.

Bluff Island. 43° 30.5' N., 70° 19.2' W.

Bluff Island is a dome-shaped island with its entire surface, inside the rocky shores and sea walls, grown up with tall timothy grass. There is no source of water on this island. Four adult Black Ducks were flushed from the dense grass on May 23, 1944. These birds gave every indication in their behavior that they were nesting, but unfortunately we had no opportunity to search for the well-concealed nests.

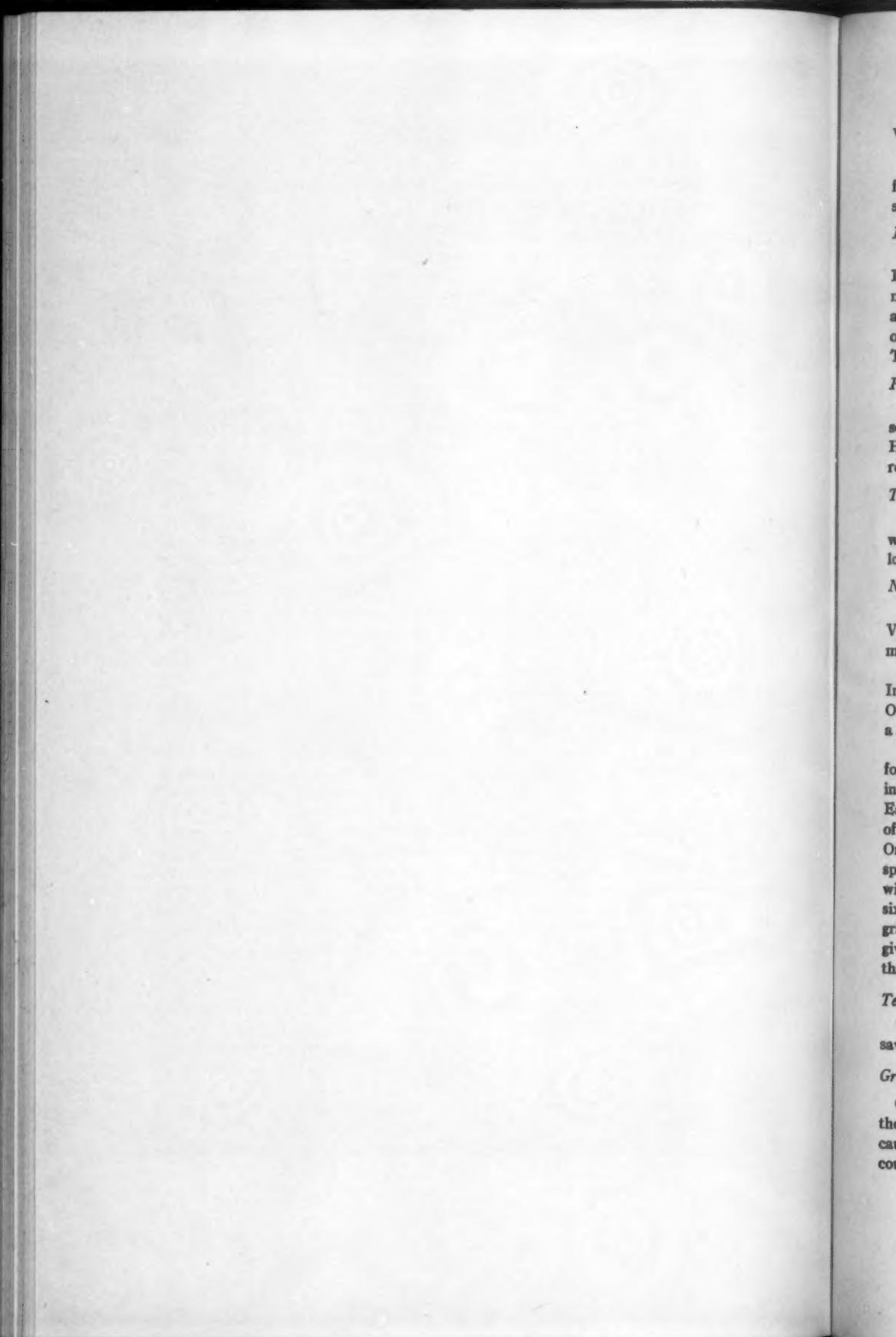
Ragged Island. 43° 43.6' N., 69° 56.3' W.

On June 3, 1941, a female Black Duck with a brood of eight young, about three or

¹ Contribution Number 15, Bowdoin-Kent Island Scientific Station, Kent Island, Bay of Fundy, New Brunswick, Canada.



GROSS: BLACK DUCK IN MAINE.—NEST OF THE BLACK DUCK ON EAGLE ISLAND,
MAY 23, 1944.



four days old, were seen in a small, temporary, fresh-water pool situated inside the sea wall along the southern shore of the island.

Mark Island. 43° 43.2' N., 69° 54' W.

Mark Island has a heavily wooded interior where a colony of 50 pairs of Great Blue Herons, a number of Black-crowned Night Herons, two pairs of Ospreys and a number of land birds nest. Around the rim of the island between the rocky shores and the trees there is a dense growth of weeds, grass and small shrubs. In the grass of this marginal area we saw two Black Ducks and a brood of young on June 14, 1943. There is no fresh water on this island.

Pumpkin Island. 43° 45.2' N., 69° 54' W.

On June 6, 1942, a female Black Duck with five downy young, a few days old, were seen among the rocks along the shores of Pumpkin Island. In addition to the many Herring Gulls, there is a large colony of Double-crested Cormorants nesting on this rocky outpost island.

The Hypocrites. 43° 48' N., 69° 35.3' W.

On June 17, 1943, a female Black Duck was seen on the Hypocrites. Her behavior was such that it was evident that she had a brood of young which we could not locate among the great masses of broken rock and huge boulders.

No Man's Land. 43° 53' N., 68° 52.2' W.

This island is a member of the Metinic group situated about 12 miles south of Vinalhaven Island in Penobscot Bay and 20 miles southeast of Rockland on the mainland.

On June 11, 1943, four adults were flushed from a dense cover of weeds and grass. In a low marsh-grass area we found a nest with nine eggs, three of which were pipped. On the same date a female and her brood of five young were seen scrambling about a small fresh-water pool among the rocks.

On June 2, 1944, we found six nests with eggs and two broods of young, a record for numbers of Black Ducks nesting within the limits of an island only a few acres in area. Of the nests containing eggs, two were found in thickets of raspberry bushes. Each of these nests contained nine eggs. One egg of one nest contained an embryo of 12-days incubation and one egg of the other had an embryo of 18-days incubation. One nest containing seven eggs was found concealed under the branches of a fallen spruce tree. One egg examined was fresh. There were two Herring Gull's nests within four feet of this Black Duck's nest. The other three nests containing five, six and seven eggs, respectively, were all found in a small area of thick, tall, marsh grass. These nests were not more than 15 to 20 feet apart. E. H. Forbush (1925) gives an account of a brood of Black Ducks he observed on No Man's Land, indicating that these birds have been breeding there for some years.

Ten Pound Island. 43° 50.8' N., 68° 53.2' W.

Ten Pound Island is also a member of the Metinic group. On June 2, 1944, we saw two adults and a brood of five young on the rocks of the eastern side of the island.

Great Spoon Island. 44° 2.5' N., 68° 33.5' W.

On June 10, 1943, we saw a female Black Duck and two ducklings scampering over the rocks at the southern end of the island. The two young, about ten days old, were caught and banded. There were probably other members of the brood which we could not find.

Schoodic Island. 44° 28' N., 68° 2' W.

A nest and seven eggs of the Black Duck were found in the marshy central section of the Island on June 12, 1941. Four other adults, which may have been nesting, were flushed from the same area. Adults were seen in 1942 and 1943 but no nests or young were discovered during these visits.

Of the 21 records of nests and young, two were obtained in 1941, one in 1942, six in 1943 and twelve in 1944. Since we visited practically the same islands each year, the increase indicated by the number of records is significant. In addition to the above records, Black Ducks were seen on or near six other islands but there was no evidence of their nesting.

There has been a marked general increase in the sea-bird population along the Maine coast in recent years, and our records seem to indicate that the Black Duck is also becoming well established as a nesting species on our coastal islands. Many of the eleven islands listed in this report presented little to attract a freshwater Duck. It is probable that many of the inner, larger islands, which provide more favorable conditions, are inhabited by more nesting Black Ducks than we have supposed.—*ALFRED O. GROSS, Bowdoin College, Brunswick, Maine.*

Observations of Red-breasted Nuthatches.—To those who have enjoyed the antics of nuthatches at their feeding-trays, the following observation should prove interesting. While hunting in Corbin Park, near Newport, New Hampshire, on January 14, 1945, Ralph C. Morrill, of the Peabody Museum staff, saw about a dozen Red-breasted Nuthatches (*Sitta canadensis*) feeding on the entrails of a deer that had been dressed in the woods. Later in the day, and in another part of this extensive forest, he was attracted by shrill squeaks issuing from a small white pine tree. The disturbance proved to be an 'assault' by ten or a dozen of these nuthatches, possibly the same group, upon a little Saw-whet Owl (*Cryptoglaux acadica*). Apparently only the nuthatches were excited for, while the owl sat quietly, the former continually darted about it, over and under the limb which served as a perch, but not approaching nearer than six or eight inches from the owl. And they were doing all the squeaking.—*STANLEY C. BALL, Peabody Museum (of Natural History), Yale University, New Haven, Connecticut.*

Additional unrecorded Passenger Pigeons from New York State.—On December 29, 1942, when I called upon Dr. T. Van Hyning, Director of the Florida State Museum in Gainesville, I observed two freshly mounted Passenger Pigeons, *Ectopistes migratorius* (Linnaeus), on the mantle in his office. In correspondence immediately subsequent to my visit, Dr. Van Hyning stated that the two pigeons, a male and a female, had been purchased not long before from Ward's Natural Science Establishment in Rochester, New York. The specimens were collected by the late Charles A. Bullock of Ohio, Herkimer County, New York, "about" 1890 and were taken in that vicinity.

It may be of interest to know that the purchase price of these two Passenger Pigeons was one hundred dollars which Dr. Van Hyning considered "extremely reasonable for the fine specimens."

Further general interest attends the fact that these birds, together with another individual not concerned in this note, are now displayed in a small habitat group in the Florida State Museum under Accession No. 82209 of that institution.

Both Dr. Van Hyning and I have endeavored to obtain further information on the two New York State Passenger Pigeons discussed here but without much success. Mr. Burt M. Robinson, current District Superintendent of Public Schools, Poland,

New York, has kindly acted as intermediary for me in contacting Mrs. Signa Bullock, daughter-in-law of the late Charles Bullock, collector of the pigeons. Mr. Robinson reports that "Charles Bullock for many years had the mounted birds in his home in the Town of Ohio, Herkimer County. Shortly after the death of Mr. Bullock the birds were sent to Ward's Natural Science Establishment . . . I do know that in the memory of some of the older residents in the Town of Ohio, Passenger Pigeons were very plentiful and were killed in great numbers."

Although the definite data concerning these specimens of historic interest are rather meager, it seems worth while to record their current whereabouts and as much reliable information as can be ascertained concerning them.—DAYTON STONER.—
New York State Museum, Albany, New York.

Possible intergrades between the Myrtle and Audubon's Warbler.—While engaged in wildlife research in Rocky Mountain National Park, Colorado, I had opportunity to study and collect specimens of the birds inhabiting the park. On May 2, 1940, I observed an adult male warbler that sang the typical song of *Dendroica coronata*, and was apparently identical with the normal Myrtle in plumage, except for a conspicuous yellow area on the throat. I collected the bird, which is now in the Park Collection. During the following week, I saw several more of these aberrant warblers, all of which sang exactly like normal Myrtles. They were with flocks of typical Myrtles, sometimes accompanied by Audubon's Warblers. Two or three similar skins are in the collection of the Colorado Museum of Natural History, all taken in Colorado. There is a single skin in the American Museum of Natural History, no. 381799, labelled *D. auduboni*, which is a characteristic Myrtle Warbler, except that the fore half of the throat is bright lemon; the rest of the throat, ashy-white. This bird was collected April 6, 1904, at Witch Creek, California.

It is possible that these aberrant birds represent intergrades or hybrids between the Myrtle and Audubon's Warblers, in which case their natal area presumably would be in a localized region of overlap in British Columbia. It is also likely that these Myrtle Warblers, and perhaps all of the individuals that migrate through the park, properly belong to the race *Dendroica coronata hooveri* McGregor, recognized in the Nineteenth Supplement to the Fourth Edition of the A. O. U. Check-List (Auk, 61: 459, 1944).

I have been informed that there may be a previous reference in the recent literature to the occurrence of such aberrant warblers, but the exigencies of naval duties prevents my locating this reference. This note is submitted to call the attention of students working in the field to the desirability of determining the frequency of the occurrence of such birds, and their range and breeding site.—LT. (J.G.) FRED MALLERY PACKARD, USNR, *Passaic, New Jersey.*

Natural hybrids between *Dendroica coronata* and *D. auduboni*.—Lieutenant Fred M. Packard wrote me some time ago that he had submitted to the Auk a statement of his observations of presumed hybrids between the Myrtle and Audubon's Warblers in Rocky Mountain National Park. Through the courtesy of Dr. Zimmer I have had the opportunity of examining his statement, published elsewhere in this issue. The basis for his suggestion was the observation of birds giving the Myrtle Warbler song but with yellow on the throat. It seems desirable to publish at the same time a description of some other Colorado specimens that seem to be hybrids, together with a brief summary of previous reports.

The distinctions between *Dendroica coronata* and *D. auduboni* are several in number, but the recombinations of these characteristics in presumed hybrids are more

difficult to analyze than in the relatively simple case of hybridization between the eastern and western flickers. In the latter case, striking new combinations are readily recognized as hybrids, even in the field. There is less possibility of obvious new combinations in hybrids of the Myrtle and Audubon's Warblers, because the only consistent, pronounced difference between the two species is the presence of a white throat in the former, a yellow one in the latter. The hybrids which I wish to describe are all presumed to be hybrids because of the fact that the throat color is not all white, nor all yellow, but is mixed. It is possible that other specimens in the collections examined are also hybrids, but in this report the criterion of hybridization has been limited to mixed throat color.

The general color pattern of these two species is so highly characteristic, and yet so nearly identical, that it is common practice to distinguish them in the field solely on the basis of throat color. They may be considered a pair of closely related species which diverged relatively recently from a common stock. Perhaps at the time of the southernmost advance of Pleistocene ice they were completely isolated geographically. We can imagine that as the ice retreated and each population extended its range to the north, the ranges approached and overlapped before complete genetic incompatibility between the species had been established. Assuming such a condition, it is not only possible but probable that hybridization occurs. Furthermore, if the species cross is fertile, it is likely that the hybrids may cross with either parent species. Hence we can expect to find not only occasional clear-cut hybrids, perhaps of first generation crosses, but descendants of various degrees of back-crosses. While the area of overlap during the breeding season may not be great, the area of overlap during migration is quite extensive. Hence, hybrids might mingle with either parent stock and eventually introduce hybrid traits in a region in which one species breeds in apparent isolation from the other. This is true because there is seemingly no factor of segregation, in behavior or ecological preference, during migration. Both species feed in the same trees at the same time during spring migration at Boulder, Colorado, and even move from tree to tree as if members of the same flock. Furthermore, if hybrids do occur, we should expect to find them particularly numerous in the region in which migration routes coincide. It is not surprising, therefore, that a relatively large number of apparent hybrids have been collected in Colorado.

The color differences between the adult males may be considered four in number (Ridgway, 'Birds of North and Middle America,' 2: 551-552): in *D. coronata* there is a white throat, black auricular region, less white on greater and middle wing coverts, white on the inner webs of the outer two or three rectrices; in *D. auduboni* there is a yellow throat, blue-gray auricular region, more white on greater and middle wing coverts, white on the inner webs of the outer four or five rectrices. To these may be added the average darker upper parts of *coronata*, and average darker breast of *auduboni*. Differences in size are probably not significant. Examination of a large series of each species leads one to believe that there would be considerable difficulty in the recognition of hybrids on the basis of variation in color of the auricular region, the amount of white on the wing coverts, or the differences in average color of upper parts and breast. Observers have been led to assume that the following conditions suggest hybrid origin: a white-throated male with four or five outer rectrices marked with white; a yellow-throated male with only two or three outer rectrices marked with white; a male in which the throat is neither all white nor all yellow, but mixed. In this report, only the last condition has been recognized as a criterion of hybrid origin.

Hybrids have been described on several previous occasions. The first time, apparently, was by W. P. Taylor (Univ. Calif. Publ. Zool., 7: 173-177, 1911). The

specimen was an adult male collected in California (M. V. Z. No. 8687). The throat was "white, modified . . . by a slight wash of yellow." The amount of white on the wing coverts was intermediate between that of the two species, as was also the color of the auricular region. The white areas on the rectrices involved the outer four, with the fourth having a slight indication of white. A much later account was that by Joseph Mailliard (Condor, 39: 223-225, 1937), in which six presumed hybrids from the Mailliard and the California Academy of Sciences collections were described. One of these specimens (Mailliard Collection No. 6840) had "some lemon-yellow feathers among the white feathers of the chin and middle throat," and had white on the fourth rectrix from the outside. Others were diagnosed as hybrids because, although the throat was white, four or more rectrices were marked with white. This method of diagnosis was questioned in a brief unsigned review of Mailliard's paper in the Auk (55: 304, 1938, probably by the late Dr. G. M. Allen) on the grounds that eastern specimens of *D. coronata* occasionally have four or more outer rectrices marked with white. As a matter of fact, there is one specimen of *D. coronata* in the Aiken Collection at Colorado College (No. 3779), from Philadelphia, which has some white on all rectrices, even the sixth. Is the existence of such a condition valid ground for considering it a hybrid? I think that is doubtful, although this same criterion has been used recently by Gayle Monson and Allan R. Phillips in a paper entitled 'Bird Records from Southern and Western Arizona' (Condor, 43: 108-112, 1941). An adult male collected in Arizona was diagnosed as a hybrid on the grounds that, while otherwise typically *coronata*, it had "large white spots on the outer four pairs of rectrices, and white edgings on the other two pairs." In the same paper the statement was made that "hybrids of these two species appear almost as commonly in Arizona as pure-blooded *coronata*," but no other criterion of hybridization was suggested.

The specimens from Colorado collections which I wish to mention are ten in number, all males, and all but one collected in Colorado. If hybrid males exist, there should also be hybrid females. Unfortunately, the distinctions between the females of these species are less definite than those which separate the males, and we are consequently not on very safe ground in speculating about hybrid females. Five of these males are from the collection of the Colorado Museum of Natural History, Denver; four from the Aiken Collection, Colorado College, Colorado Springs; and one from the University of Colorado Museum. To the authorities of the first two institutions I am indebted for the privilege of examining the specimens. These two collections are the largest in Colorado; there are over 150 specimens of the two species in the Denver collection and nearly 60 in the collection at Colorado Springs. There are 26 specimens in the University of Colorado Museum. About 160 of the total were labelled *D. auduboni*, the remainder *D. coronata*. In the aggregate, about 85% of the specimens were collected in Colorado.

All of the specimens here recorded have both white and yellow feathers in the throat patch. The general impression one receives may be that of a pale yellow throat. Closer examination shows that the yellow feathers are usually concentrated near the center and toward the anterior margin of the area. At least in those cases where white predominates, individual feathers have some yellow and some white barbs; the yellow and white occurs in patches on individual feathers.

In the Colorado Museum of Natural History, the males with mixed yellow and white throats are: No. 2263, Jefferson Co., Colo., May 2, 1911, white on margins of fourth and fifth rectrices; No. 3623, Montezuma County, Colo., May 9, 1913, outer four rectrices with white; No. 5411, Kerr Co., Texas, April 24, 1915, white spots on

outer five rectrices; No. 18418, Henderson, Colo., all six rectrices marked with white; No. 23913, Greeley, Colo., Sept. 16, 1942, only three outer rectrices with white. Of these, Nos. 3623 and 5411 were labelled *D. auduboni*; the other three were labelled *D. coronata*, but No. 2263 has "auduboni" written in pencil above the word "coronata." No. 23913 is quite typically *coronata* except for a few yellow feathers in the anterior lateral margins of the throat patch.

In the Aiken Collection, the apparent hybrids, all males, are as follows: No. 3784, El Paso Co., Colo., May 18, 1878, only the outer three rectrices with white; No. 3792, nr. Colorado Springs, Colo., May 8, 1900, first five rectrices all with white; No. 6758, Colorado Springs, Colo., May 2, 1929, all rectrices marked with white, though very narrow on sixth; No. 6762, Colorado Springs, Colo., April 24, 1933, outer five rectrices with white. The first and third specimens have black auriculars; the second, blue-gray; the fourth, dark gray (darker than *auduboni*, lighter than *coronata*). The white markings on the wing coverts are less conspicuous in every case than in typical *auduboni*. No. 6758 was labelled "hybrid"; the others were labelled *D. auduboni*.

The presumed hybrid in the University of Colorado Museum (No. 4285) is similar to No. 23913 in the Denver collection, but with even less yellow in the throat. It was collected at Boulder, Colo., April 30, 1937. The outer three rectrices are the only ones marked with white. All coloration is typically *coronata*, except for the presence of a faint yellow wash on the throat. This is produced by diffuse yellow patches involving part of the rachis and a few adjacent barbs and barbules on about eighteen feathers; no one feather is as much as half yellow on the exposed part.

In this last-named specimen, as in all others closely examined, the yellow pigment seems to be just as bright in the hybrid specimens as in the others; the pale appearance is due to restriction in area, either to fewer feathers or to portions of individual feathers. The reduction in yellow on the throat is not associated with reduction in yellow in the other patches which are typically yellow. It appears that we are dealing here with a criterion of hybridization as valid as any we might obtain without direct observation of cross-breeding.—GORDON ALEXANDER, *University of Colorado, Boulder, Colorado*.

Random distributional records.—In the course of work and study on the combined bird collections of the United States National Museum and the U. S. Fish and Wildlife Service (Biological Survey), the writer has found certain data which he feels will add to our present knowledge of the distribution of those species which follow:

Puffinus carneipes Gould

George G. Cantwell obtained an adult female specimen of the Pale-footed Shearwater on June 18, 1920, at a point ten miles offshore from Cape Flattery, Washington. This specimen, now in the Biological Survey collection, constitutes the only known record of this species from the State of Washington. Other specimens of this shearwater have been recorded from the vicinity of Point Pinos, California, by Beck [Proc. Calif. Acad. Sci., 3 (Series 4): 66, 1910] and from Goose Island Banks, British Columbia by Cowan (Murrelet, 23: 69, 1940). P. W. Martin (Condor, 44: 28, 1942) also lists specimens from Goose Island Banks, which are now in the Provincial Museum at Victoria, British Columbia. Brooks (Condor, 44: 33, 1942) lists several sight observations of this species from north of Queen Charlotte Islands by R. M. Stewart, and one in Victoria Harbor by Captain G. D. Sprot. Although this species has been reported but a few times for North America, it perhaps is fairly regular in occurrence off the Pacific coast of the United States and Canada, as pointed out by

Loomis in Bent's "Life Histories of North American Petrels and Pelicans and their Allies" (U. S. Nat. Mus. Bull. 121: 61-62), and by the other individuals who have noted this shearwater in American waters.

Guara alba (Linnaeus)

On June 27, 1916, James L. Peters collected a juvenile male White Ibis which he discovered in a wet meadow bordering Crowder's Creek, five miles east of Kings Mountain, Cleveland County, North Carolina. This constitutes the second specimen of this species for the state and the first recorded occurrence in the interior of the state. Pearson (Auk, 16: 247, 1899) first recorded a specimen of the White Ibis from coastal North Carolina, and Brimley (Auk, 58: 107, 1941) cites an observation of an immature White Ibis from the coast region also. Recently Stevens (Raven, 15: 84, 1944) observed two immature individuals of this species in interior Virginia.

Somateria mollissima v-nigra G. R. Gray

Records of the Pacific Eider from the interior are very rare. There is one specimen (No. 241121 Biological Survey collection) collected October 15, 1912, 15 miles north of Valley City in central-eastern North Dakota, by M. J. Kernall, which seems to be the first record for the state. Apparently the only other known occurrence of this eider in the interior of the United States was in Iowa (DuMont, Wilson Bull., 46: 203, 1934).

Scotia plecta nebula nebula (Forster)

The Reverend P. B. Peabody sent to the former U. S. Biological Survey a contour feather which was identified by H. C. Oberholser as from a Great Gray Owl. The feather was found in March, 1905, in a nest of *Perisoreus canadensis albescens*, at Bear Lodge, Crook County, northeastern Wyoming. This constitutes the only known record for this species from the eastern part of the state, although there are numerous sight records from northwestern Wyoming, and a record of one specimen collected (Kemsies, Wilson Bull., 47: 70, 1935; Thompson, Condor, 36: 153, 1934; Long, Condor, 43: 77, 1941; Test, Condor, 43: 160, 1941; Dixon, Condor, 46: 244, 1944; and McCreary, Wyoming Bird Life, rev. ed.: 49, 1939). There is also a mounted specimen recorded from Wells P. O., Uinta County, in southwestern Wyoming (Bond, Auk, 18: 107, 1901).

Sterna paradisaea Brünnich

There is an adult male specimen of the Arctic Tern in the collection of the U. S. National Museum (No. 58990) which has no further locality data than "New Jersey." It was collected in June, 1848, by Dr. A. L. Heermann. This apparently represents the only known specimen of Arctic Tern from New Jersey. Early authors mention the occurrence of this species in the state, but give no definite records. Stone (Bird Studies at Old Cape May: 579) does not consider any of the earlier published accounts as valid for the state, nor does Cruickshank (Birds around New York City: 241, 1942) actually record this species from New Jersey, although he cites numerous records from the shores of Long Island. Recently Mackenzie (Raven, 15: 87, 1944) recorded two Arctic Terns at Back Bay in southwestern Virginia, which his description indicates that he was correct in identifying.

Turdus migratorius migratorius Linnaeus

Alexander Wetmore (Proc. U. S. Nat. Mus., 93: 303, 1943) first recorded the Eastern Robin from Vera Cruz, México. There is also in the collection of the U. S.

National Museum another example of typical *migratorius* from Vera Cruz, taken by Botteri at Orizaba and without further data. It was entered as No. 38120 in the National Museum catalogue in 1865. It has the two outer pairs of tail feathers tipped with white, the under parts dark chestnut; wing, 128.5 mm., and tail, 100 mm. There are other specimens of the Robin in the collection of the National Museum taken by Botteri at Orizaba, but these are not the eastern race, *migratorius*.

Dendroica nigrescens (Townsend)

McCreary (Wyoming Bird Life: 86-87, 1939) says that the Black-throated Gray Warbler is a summer resident in the southwestern part of Wyoming on the authority of Cary (N. Amer. Fauna, 42: 35), who states that it probably breeds in the Transition Zone, and on the basis of several sight observations at Green River by Dorothy Waltman during May and June, 1929. H. C. Oberholser [Sci. Publ. Cleve. Mus. Nat. Hist., 1 (4): 101, 1930] also includes the species as occurring in Wyoming, but gives no further data.

Cary (*loc. cit.*) lists the species but does not record any specimens seen or taken during the breeding season in Wyoming, and it may be concluded that the adult male specimen (No. 238143), taken May 31, 1912, by Stanley G. Jewett (orig. No. 399) at Mountainview, Uinta County, was not considered by him to be a breeder or was inadvertently overlooked, as he included Jewett's work in the paper. Nevertheless the above-mentioned specimen represents the first specimen recorded from Wyoming.

Oporornis tolmiei (Townsend)

Macgillivray's Warbler was first recorded for Oklahoma as a fall migrant from Kenton by Sutton (Annals Carnegie Mus., 24: 41, 1934). In the collection of the U. S. Fish and Wildlife Service (Biological Survey) is a female specimen (No. 349259) from Kenton taken on May 24, 1937, by Thomas D. Burleigh, which apparently is the first known record for spring and the second known occurrence for the state. Burleigh, in his field notes, says that it was a belated migrant. It appears that this warbler is an occasional spring and fall migrant through the Panhandle of Oklahoma.

Passerculus princeps Maynard

In 1887 the U. S. National Museum received a number of specimens from S. Albert Shaw, taken in New Hampshire. Among them was one male Ipswich Sparrow, taken January 25, 1887, now No. 111340 in the U. S. National Museum collection. On the label is written: "Common the first week in December, but very rare after that." Although the Ipswich Sparrow is a common migrant and winter resident along the New England coast, and despite the several recorded sight observations for New Hampshire, this specimen appears to be the only known example of this species to be taken in New Hampshire (Allen, Proc. Manchester Inst., 4: 138, 191, 1902; Brown, Auk, 13: 84, 1896; and Shelley, Auk, 48: 615, 1931).

Junco caniceps caniceps (Woodhouse)

One specimen, a male, No. 260792, Biological Survey collection, was taken by Remington Kellogg at Glendive, Dawson County, in central-eastern Montana, on May 5, 1916. This is the only known specimen of this species to be taken in Montana and is the most northern record for its occurrence, as the species is not normally found north of central Wyoming. Miller (Univ. Calif. Publ. Zool., 44: 203, 1941) mentions a specimen from Glendive, Montana, taken in May, which he considered to

represent an instance of "abnormal migration" and to be "a fully characterized *caniceps*." It may be that the specimen to which Miller refers is the same as the bird here recorded. (For use of the trinomial see Miller, *op. cit.*: 181, 205.)

Junco sp.

There is a specimen of junco in the Biological Survey collection (No. 228417), taken July 5, 1910, at Valley, in northwestern Wyoming (10,000 feet), by Alexander Wetmore. Although the plumage of this specimen appears to be of the female type, Doctor Wetmore informs me that the bird was a male with testes apparently in breeding condition. The specimen is duplicated by several female examples of *Junco hyemalis cismontanus*, from Bennett, northwestern British Columbia, in the color of the head, neck, back, and under parts, but exhibits no brownish or reddish wash on the sides or flanks. The outer two pairs of rectrices are pure white, and the third pair shows a trace of black on the outer web, while its inner web is about half black and half white. On the upper surface it also resembles *J. o. regulus montanus*, but lacks the sharp contrast of the head and the back. It is similar to *J. o. mearnsi* in the presence of considerable white in the third pair of outer tail feathers, but the head, as well as the gray of throat and jugulum, is darker. Compared with breeding females of typical *J. h. hyemalis* from Alaska, the head is darker and the back is brownish as in *montanus* or *cismontanus*; below it is practically identical with *hyemalis*, having no buffy or reddish wash on the sides and flanks; the jugulum and throat, however, are slightly darker than in typical *hyemalis*. Two other specimens, taken by Doctor Wetmore at the same locality in July, are typical *mearnsi*, and he says that they were breeding commonly there.

This puzzling junco, found in the breeding range of *J. o. mearnsi*, is less like *mearnsi* than any other of the juncos to which it may be related. It may be a hybrid between *J. o. montanus* and *J. h. hyemalis*, as it shows some indication of the characters of both, or it may be a vagrant individual of *J. h. cismontanus*. (For use of name see Miller, *Univ. Calif. Publ. Zool.*, 44: 402, 1941.) In any event this bird must have wandered considerably from its normal breeding range, as the juncos sometimes do according to Miller. Some physiological abnormality may have been responsible for this, as well as for the apparent female plumage worn by a bird sexed by dissection as a male.—ALLEN J. DUVALL, *Fish and Wildlife Service, U. S. Department of the Interior, Washington, D. C.* February, 1945.

Further New York State records for the Great Gray and Richardson's Owls.
—Since the appearance of my note on a specimen of "Great-Gray Owl from New York State" (Auk, 55, 279-280, 1938) I have acquired two additional records of this bird from the state. And because these, together with two Richardson's Owl records which incidentally came to light, have remained unreported in the literature, it seems worth while now to chronicle the data associated with them.

My first supplementary information regarding the Great Gray Owl was obtained from the late Dr. William Macartney of Fort Covington, Franklin County, New York. His observations and specimens formed the basis for W. DeW. Miller's note on "Richardson's and Other Owls in Franklin County, New York" (Auk, 32, 228, 1915). Under date of September 29, 1939, Dr. Macartney wrote me at length concerning his collecting of, and personal observations on, both the Great Gray and Richardson's Owls. The portions of his letter dealing with the heretofore unreported specimens follow:

"I have seen and identified the Great Gray Owl at various times during the past sixty years since I saw the first specimen . . . It appears to be a rare winter

resident in this locality. I have a specimen in my collection which I shot on March 15th, 1883 and mounted at the time. It is apparently a female bird and is still in a fairly good state of preservation.

"The latest one was brought to me on January 16th, 1931 but I did not mount it for the reason that it had a broken wing, had been in captivity for several weeks and its plumage was so badly frayed and damaged that it was unfit for preservation. The mounted specimen referred to above was killed in Fort Covington, the latter one in the adjoining town of Westville, N. Y."

At my solicitation, subsequent to writing the above, Dr. Macartney thoroughly substantiated this information by a complete re-check of his notes.

Following the publication of my note on the Great Gray Owl (*loc. cit.*), Mr. W. A. Dence, Assistant Director of the Roosevelt Wildlife Forest Experiment Station in Syracuse, New York, wrote me in part as follows:

"We have a specimen of this owl in our Museum that we obtained from Mr. Clock of Canastota. This is included in the group of owls as shown on page 92 of volume 6, number 1 of our Wildlife Bulletin [1931]. Reference is also made to it on page 94 of the same bulletin."

The "group of owls" mentioned by Dr. Dence is a photographic reproduction of 19 mounted raptorial birds, mostly Snowy Owls (Plate 3 of the above-noted publication). The descriptive caption reads in part: "Group of winter birds of prey taken in Madison County [New York] during the winter of 1926-1927 and mounted by P. E. Clock, Taxidermist of Canastota . . ." The specimen of Great Gray Owl in question was in the collection of Mr. Clock when the photograph was taken in 1927. Some time later, as indicated by Mr. Dence, the specimen was acquired by the Roosevelt Station. Recently, Mr. C. J. Spiker, author of the Bulletin, supplied me with the more definite information that this owl was taken by a farmer near Canastota, exact date unknown, but "prior to 1927." This statement, together with that on page 94 of the Bulletin would place the taking of the specimen at some time between 1922 and 1927.

In addition to reporting for the first time two additional specimens of Great Gray Owl taken in Franklin County, New York, and to delimiting the time of taking of the heretofore reported Madison County specimen, I should call attention to the omission from my 1938 note in the Auk of Dr. C. P. Alexander's two specimens of this owl taken in Fulton County, New York, one on November 15, 1906, the other December 16, 1906 (*Oologist*, 24, 187, 1907).

Two hitherto unreported New York State records for Richardson's Owl also have been furnished me by Dr. Macartney who, in the letter mentioned earlier in this note, wrote in part:

"It may be of interest to you to know that I killed a Richardson's Owl in the winter of 1878. This specimen was shot up so badly that I only preserved the head, knowing it to be rare . . ." On January 19, 1916 "I secured another owl and wrote in to the Museum of Natural History in New York City asking if they knew of anyone who could use this frozen specimen and got a prompt request that I send this one in, which I did."

Dr. John T. Zimmer of the American Museum of Natural History informs me that this latter individual taken at Fort Covington, New York, is a female bearing Museum No. 129290.—DAYTON STONER, New York State Museum, Albany, New York.

Rivoli's Hummingbird (*Eugenes fulgens*) in Colorado.—In the summer of 1942, I received a letter from George J. Bailey, an attorney at Walden, Colorado, regarding records for this state of the above species, as follows:

"Will you let me know whether there is a Colorado record for Rivoli's Hummingbirds? The books I have available do not list one for Colorado.

"The reason I inquire is that there has been a male Rivoli here since June 30th. It first showed up at the Francis P. Murphy ranch near Spicer on June 30th. He maintains feeding stations for humming-birds. My place is about two miles from the Murphy ranch and I have been feeding humming-birds since 1929. The bird came to my place July 3rd and has been there two or three times a day each day since. It seems to go back and forth between the two places.

"Although this bird is quite shy it does feed out of bottles in which we have syrup and we have had ample opportunity for observation. The Broad-tail and Rufous Hummingbirds pay no attention whatever to my wife and me and as we feed as high as three quarts of syrup a day we estimate that we are feeding as many as 100 birds a day, probably more. There is no possibility of confusion, as we are thoroughly familiar with our regular birds.

"The large size, green gorget, white eye marks, purple top of head, all mark the bird. For some reason the feathers on the top of the head are usually about half erect."

Inasmuch as this seemed a very unusual record, I arranged to visit Mr. Bailey's summer cabin near Spicer, Jackson County. On July 19, Fred G. Brandenburg and I visited the Murphys and they reported the stranger had appeared in the morning, but had not been seen for some hours. We then travelled on to the Bailey cabin in a grove of aspens, at an elevation of 8,700 feet, where the feeding station of a dozen or more vials of sweetened water was maintained.

There were numerous Broad-tailed Hummingbirds (*Selasphorus p. platycercus*) and a few Rufous (*Selasphorus rufus*) hovering over the bottles, but the Rivoli's was conspicuously absent. The Baileys reported the large hummer had last been seen at eight the evening before, and that it was wild and did not remain long. While we were in the cabin looking over Mrs. Bailey's excellently kept notes of the birds of the vicinity of her summer home, Mr. Bailey reported the hummer had returned. Brandenburg and I examined it with binoculars at fifteen feet and I jotted down the following description: One half or more larger than the Broad-tails which were near at the time. Large size particularly noticeable, reminding one of tropical forms. Green gorget repeatedly flashed conspicuously; head and breast dark; conspicuous white spot behind the eye, and white line running from the corner of the mouth, seemingly along the gorget. Tips of wings seem to come to tip of tail. Bird did not hover, and feed while flying but instead rested on lip of cup.

The bird remained in the vicinity for about five weeks and did not return the following season. I have hesitated to publish such an unusual occurrence on the basis of an observation only, but I feel there can be no doubt about the identification.

—ALFRED M. BAILEY, *The Colorado Museum of Natural History, Denver, Colorado.*

The Greenland Wheatear in Luce County, Michigan.—On October 7, 1943, a bird flew past me at a distance of not over 20 feet as I was about to depart from one of my bird-banding stations at my home a mile and a half nearly due south of McMillan, Luce County, Michigan. When in flight, the black and white plumage was plainly noted, and I was sure that it was a bird new to me. It alighted on a post at the east side of the garden and at a distance of not over 75 feet from me where I studied it for a few minutes with my 7-power Mirakel glass. Among the colors noted were a black line through the eyes, black on the primaries with light color on the outer edges, white rump, end of tail black, with basal two-thirds white, and under parts buffy. These markings proved this bird to be a Greenland Wheatear (*Oenanthe oenanthe leucorhoa*), the first of this species that I have ever seen. These colors agreed with those given for this species by Frank M. Chapman in his 'Birds of Eastern

North America': 499, 1912. The state of Michigan is not included in the range of the Greenland Wheatear given in the A. O. U. Check-List, fourth ed.: 202, 1931.

This bird was seen again on Oct. 8 and 9 within 20 rods east and west, and 20 rods north and south of the spot where it was first found. In its feeding habits, it closely resembled the Robin (*Turdus migratorius*), hopping about for short distances and looking for insects when it stopped. But, when on the ground, it was always seen on bare places where no grass was growing, and I did not see it try to get insects by picking into the ground as the Robin does. On Oct. 9, at about 4:30 P. M., I flushed it from a small spot of not over three square feet where dirt had been put a few days before. It flew up to a low branch of an apple tree where I could observe its plumage closely. At 2:00 P. M. the same day, I flushed it from the wheel-tracks of a driveway. It flew up about 12 feet to a martin house where it watched for insects in the manner of the Eastern Bluebird (*Sialia sialis sialis*). It sighted a grasshopper or cricket in the grass not more than 15 feet from the martin house, dropped down and captured it, and ate it after killing it by beating it a few times as the Bluebird does. I did not see it alight on wires during any of these days nor did I hear it give a single note.

The weather was partly cloudy on Oct. 7 and the forenoon of the 9th; the rest of the time was chiefly clear. The temperature was 52° to 73° F. on the 7th; 40° to 73° on the 8th; 37° to 53° on the 9th.—OSCAR MCKINLEY BRYENS, R. F. D. No. 1, McMillan, Luce County, Michigan.

Black-billed Cuckoo nesting in Oklahoma.—The fact that Black-billed Cuckoos (*Coccyzus erythrophthalmus*) are considered rare transients in Oklahoma with a few old (1926-1927) breeding records for the northeast corner should make the following observations interesting to many readers. They pertain to a nesting pair found near Oklahoma City in the geographical center of the state, representing an extension of the breeding range 120 miles to the southwest.

One thousand yards north of Lake Overholser, the original city reservoir, is a growth of willow saplings along the east bank of the North Canadian River. While exploring the heart of this willow stand on June 11, 1944, I first discovered a cuckoo's nest three feet from the end of my nose. It was in a willow sapling precisely at eye level and contained a brooding bird. As soon as my eyes fell on the bird, it sprang up from the nest to a perch a dozen feet away, then disappeared. In the nest were four blue-green eggs. I left the vicinity for ten minutes and found a bird on the nest when I returned. As it flew off the nest it displayed a uniform coloration above, with narrow white tips on the rectrices. As it perched, not far from the nest, it emitted a song and then disappeared. About thirty-five minutes later, when I approached the nest for the third time, there was again an adult brooding. Cautiously circling the nest at a radius of about fifteen feet I observed the bird from all directions with 8 × 30-power binoculars. The glossy black bill and a red rim around the eye could clearly be seen.

The nest was about thirty feet from the water's edge and on June 13, when I returned to the area, there was ten inches of water covering the narrow trail that led to the nest, and I could not visit it. Recent showers had caused the river to overflow and the entire growth of willows was standing in flood water. On June 17 when I was able to visit the nest, it contained four pin-feather young with an adult bird brooding. The young were covered with black skin in which sparse gray pin feathers were growing. The remiges were still encased, and, as far as I could tell, the eyelids were still closed. On June 22, the occasion of my next visit, the nest was deserted, with only chipped egg shells remaining in the bottom.

During the period of observation, several pairs of Yellow-billed Cuckoos were noted in the locality and there were excellent opportunities to distinguish the two species by both appearance and song.—GERALD ROGERS, CAPT. A. C., Oklahoma City, Oklahoma.

Blue-breasted Cyornis in the Malay Peninsula: A Correction.—Riley (U. S. Nat. Mus. Bull. 172: 448, 1938) has recorded from Nakhon Si Thammarat, Peninsular Thailand, an "immature male (marked female)" of *Cyornis hainana*, collected by Hugh M. Smith on March 13, 1929. He observes that this seems to be the first record for Peninsular Thailand and might have said also that it is the first record for any part of the Malaysian Subregion.

To the end that error be not compounded by endless repetition, it should be noted that the specimen in question, U. S. N. M. No. 313345, was collected, in fact, at Sakon Nakhon (lat. 17° 10' N., long. 104° E.), a locality well within the species's normal range.

The female recorded by Riley from Bok Pyin, Tenasserim (ca. lat. 11° N.) is correctly identified and represents the most southerly specimen yet known in this direction. On the eastern (Thai) side of the Peninsula, the species has not been found south of Ban Thung Luang (ca. 11° 55' N.). That Riley's undocumented reference to the bird's ranging as far south as Trang is *lapsus calami* is indicated by his own claim that his record for "Nakhon Si Thammarat" is the first for Peninsular Thailand.—H. G. DEIGNAN, U. S. National Museum, Washington, D. C.¹

Cowbird parasitizes Wood Thrush and Indigo Bunting.—The eggs of the Cowbird (*Molothrus ater ater*) were found this spring (1943) in the nests of a Wood Thrush (*Hylocichla mustelina*) and an Indigo Bunting (*Passerina cyanea*) near Crawfordsville, Indiana. It both nests there were two Cowbird eggs and three eggs of the host. Both birds began to incubate the eggs, but, in both cases, the entire set of eggs was later found on the ground beneath the nest. The nests were about two miles apart and both were under observation. Both sets of eggs may have been destroyed by some predator but it is considered possible that the hosts might have destroyed the entire set of eggs in each case to get rid of the parasitic Cowbird eggs. If this was the case, it would be remarkable behavior. This observation is recorded to see if anyone has ever seen a bird destroy her own eggs to get rid of the eggs of another species.—HOWARD H. VOGEL, JR., Wabash College, Crawfordsville, Ind.

Three records from western Massachusetts.—As evidence of the eastward and northward trend of bird-life, and as indications of possible future breeding of various species, records of rare stragglers may be of interest. In Berkshire County, the westernmost part of Massachusetts, several birds added to the county list during the past year come under this category. This county, comprising just under a thousand square miles, extends fifty miles from the Vermont line to Connecticut, and is some twenty miles wide. In regard to the number of bird observers as compared to those in the eastern part of the state, the relationship is much the same as that of the southern bird students to those of the North Atlantic states. Here observers are few in number, and such birds may have been overlooked in past years.

The three additions to the county list were the Western Meadowlark, the Lark Bunting and a Tufted Titmouse. The first was found by Professor Sam A. Eliot, Jr., of Northampton and Stanley Clarke of Pittsfield, on July 8, 1944, at the Berkshire Hills Country Club, a favorite haunt of the Eastern Meadowlark. It sang

¹ Published by permission of the Secretary of the Smithsonian Institution.

freely and was seen many times by different observers until July 19. I observed it for a total of four hours, once timing as many as ten songs in twelve minutes.

The Lark Bunting was found at South Egremont Pond on October 24, 1944. It was in a mixed company of finches at the edge of the swamp there, and I saw it within twenty feet, perched on a bush, feeding on the ground, and three times in flight. The bird was probably an immature male, as the wing patches were large and conspicuously white.

The Tufted Titmouse appeared at a feeder in Pittsfield during the first week of January, 1945, and was then traced to many feeders in the neighborhood; its route included more than a dozen. It appeared healthy and active on January 25, but has not been recorded since the following day. From the accounts of its habits, it seems possible that it may have died of overeating!—DOROTHY E. SNYDER, *The Berkshire Museum, Pittsfield, Massachusetts*.

The Bald Eagle nesting in captivity.—Records of the Bald Eagle (*Haliaeetus leucocephalus*) nesting in captivity are rare. The files of the National Zoological Park, Washington, D. C., do not record any such event but from time to time a few eggs have been deposited on the ground in the cages. On March 4, 1945, I discovered a Bald Eagle nesting on the 'cliff' in the eagle flight-cage of the zoo. The nest was constructed of sticks and grasses that had been gathered by the birds in the cage. A good part of the material consisted of peanut bags and popcorn boxes that had been torn apart and incorporated into the nest. In this crude eyrie rested two eggs. An eagle hovered over them, wings spread in an attempt to protect them from an intruder. The incubating bird called out in defiance as I stepped near, and refused to leave the nest. Another eagle, probably the mate of the nesting bird, flew over my head and appeared angry at my presence.

The normal period of incubation of the Bald Eagle is from twenty-eight to thirty-six days. We in the zoo are not molesting this incubating eagle, and it is hoped that a family will eventually emerge from the shells.—MALCOLM DAVIS, *National Zoological Park, Washington, D. C., March 5, 1945*.

Great Black-backed Gull in Monongalia County, West Virginia.—On February 16, 1945, I found an adult Great Black-backed Gull (*Larus marinus*) at Lake Lynn, Monongalia County, West Virginia. The bird was under observation for about thirty minutes as it flew about and alighted on the broken ice which partially covered the lake. Through 7× binoculars I had every opportunity to see the bird at short range, although it was impossible to secure the specimen. The occurrence of this bird in West Virginia must be regarded as accidental, since this is the first published record for the species from the state.—MAURICE BROOKS, *Division of Forestry, West Virginia University, Morgantown, W. Va.*

American Eider in Delaware.—The occurrence of any species of eider south of Long Island is so uncommon that a record should be made of any such observation. An American Eider (*Somateria mollissima dresseri*) was killed on October 16, 1944, by a hunter on the Hundred Acre Marsh, near the mouth of the Delaware River, New Castle County, Delaware. The specimen, a female, was carefully examined by U. S. Game Management Agent, Alan W. Souder, who has had considerable experience with the eider on the coast of New England. Souder reported (December 21, 1944) that this was definitely an American Eider, not a King Eider.—CLARENCE COTTAM, *Fish and Wildlife Service, Chicago, Illinois*.

The Whistling Swan in Maine.—Because few observations of the Whistling Swan (*Cygnus columbianus*) in New England have been recorded during recent years,

it seems desirable to report that an adult specimen was observed repeatedly on November 28, 1944, near Pleasant Point, Merrymeeting Bay, Sagadahoc County, Maine, by U. S. Game Management Agent, W. B. White. The distinctive coloring and large size of this bird make it very unlikely that anyone with even a casual acquaintance with waterfowl could misidentify the Whistling Swan.

This record seems the more important because Knight ('Birds of Maine,': 648, 1908) lists but one record (doubtful) for Maine.—CLARENCE COTTAM, *Fish and Wildlife Service, Chicago, Illinois.*

Long-tailed Jaeger and other birds at Island Beach, New Jersey.—On January 21, 1945, a ten-mile walk along the beach north from Seaside Park to Point Pleasant, New Jersey, produced a list of only 24 species of birds observed. Noteworthy among these were a flock of 2000 (est.) American Brant, *Branta bernicla hrota*, flying south toward Barnegat Inlet, and two American Pipits, *Anthus spinolella rubescens*, apparently feeding on beach debris.

And of unusual interest were 92 dead birds—mostly oiled—comprising 11 species as follows:—Common Loon, *Gavia immer immer*, (7); Red-throated Loon, *Gavia stellata*, (10); Black Duck, *Anas rubripes*, (1); Long-tailed Jaeger, *Stercorarius longicaudus*, (1). Mrs. Kramer spied the jaeger lying close to the surf; it was fresh and bloody and almost completely disemboweled by gulls. It was the size of a slender Crow, and was an immature bird as was indicated by its two central tail feathers which were a scant inch longer than the rest of its tail. Because the bird was well oiled, we collected only the feet which, according to the literature, clinched the identification, which was later confirmed at the Academy of Natural Sciences of Philadelphia by James Bond. Due to the absence of belly plumage, the color phase could not be determined. Great Black-backed Gull *Larus marinus*, (4); Herring Gull, *Larus argentatus smithsonianus*, (27); Bonaparte's Gull, *Larus philadelphicus*, (3); Atlantic Kittiwake, *Rissa tridactyla tridactyla*, (1); Razor-billed Auk, *Alca torda*, (1); Dovekie, *Alle alle*, (36—of these, 17 were within a one-mile stretch of beach); Common Pigeon (1).—EVELYN Y. AND QUINTIN KRAMER, 6101 Market St., Philadelphia 39, Pennsylvania.

Eskimo Curlew in Texas.—On April 29, 1945, two Eskimo Curlews were seen at Galveston, Texas, by Mrs. Edna W. Miner, Miss Mabel Kaiser, and the writer, all of Houston, Texas. The birds were amongst a huge assemblage of marsh and shore birds, including Buff-breasted and other sandpipers, Black-bellied Plovers, Eastern and Western Willets, various herons, and hundreds of Hudsonian Curlews. All were feeding over a wide area of sand flats, shallow ponds, and grassy patches near West Bay on Galveston island. Nearness of the Eskimo Curlews to Hudsonians gave fine opportunity for comparison. Smaller size of the Eskimos and shorter length of bill were obvious, and movements of the birds, in brilliant mid-afternoon sunlight, clearly showed the large black wing area and lack of median head stripe. Fully an hour was spent checking every identification mark through eight-power glasses at a range of less than one hundred yards from our parked car. In a small puddle a few yards beyond, two Marbled Godwits fed energetically. As is often the case along the Texas Gulf Coast during spring migration, a heavy rainstorm and change of wind from south to north during the previous night brought down a swarming visitation of migrants. Our list, for ten hours of observation, totaled 128 species.—(Scr.) JOSEPH M. HEISER, JR., Det. Med. Dept., Brooke Gen. Hosp., Fort Sam Houston, Texas.

Swallow-tailed Kite in Texas.—A Swallow-tailed Kite was seen by me on the forenoon of April 23, 1945, at the Colorado River, along the main highway about one mile south of Bay City, Texas. The bird circled in leisurely fashion low above the nearby treetops, remaining in clear view for about ten minutes. This observation followed a period of squally storms, on the nights of April 20 and 21, bringing to earth waves of migrants which enabled Mrs. Conger Hagar, of Rockport, and the writer, to record a two-day (21 and 22) list of 152 species of birds, in the vicinity of Rockport, Texas.—(Sgt.) JOSEPH M. HEISER, JR., Det. Med. Dept., Brooke Gen. Hosp., Fort Sam Houston, Texas.

Blue × Canada Goose hybrid.—In December, 1945, the United States National Zoological Park received from the United States Fish and Wildlife Service, through the kindness of Messrs. John W. Aldrich, of the Washington office, and Kenneth F. Roahen, of Billings, Montana, two geese that are the progeny of a mating of a male Blue Goose (*Chen caerulescens*) and a female Canada Goose (*Branta canadensis canadensis*). The history in connection with these birds is reported by Mr. Roahen as follows: In the spring of 1936, Mr. Roahen, while on migratory-bird patrol work in South Dakota, picked up a crippled male Blue Goose which he took to his headquarters at Billings. He cared for the bird at his home for a while and later turned it over to the 'See 'Em Alive Zoo' at Red Lodge, Montana. In the spring of 1943, a female Canada Goose that had been with the male Blue Goose for a while, hatched four eggs. Three of the young succumbed in a blizzard, but the fourth one survived. It showed such definite Canada Goose markings the first year that considerable doubt existed in the minds of those who had been caring for the bird that the male parent was a Blue Goose, but late in 1944 this bird had developed the white head characteristic of the Blue Goose. In the season of 1944, the original male Blue Goose mated with another Canada female and five eggs were hatched. One of the young birds was malformed and was put to death. The two young birds that were received by the Zoo are from this 1944 brood, and in December of 1944, when they were about seven months old, the plumage pattern was that of the Canada Goose with the exception that the neck and the ventral surface of the body were speckled with white. These birds have an interesting combination of behavior characteristic of both of the parents. They are excellent swimmers, graze extensively, and enjoy sitting on the snow.

If these two young birds of the F1 generation are a true pair, it will be interesting to see whether or not they can produce young, as we expect to afford them suitable facilities for nesting.—MALCOLM DAVIS, National Zoological Park, Washington, D. C.

Hybrid between Snow and Blue Goose in Washington, D. C.—For about two and a half months an interesting goose was present at Roaches Run Wildfowl Sanctuary, on the west side of the Potomac River near the airport, Washington, D. C. On November 19, 1944, it was seen by Abby Roe and R. T. Peterson, but they did not report it. Then on December 10, 1944, Dr. Haskell B. Curry and I saw the bird at close range and reported it to the U. S. National Museum. The following day it was seen by Dr. Herbert Friedmann, W. M. Perrygo, Mrs. Roxie C. Simpson, and J. S. Webb, all from the U. S. National Museum, and A. J. Duvall, U. S. Fish and Wildlife Service. These were the characteristics noted:

General appearance whitish with black wing tips; size smaller than a Canada Goose with which it flew. On December 17, 1944, it was seen on land with the Canada Goose by Mr. Perrygo and Mr. W. L. Brown, of the National Museum. They noted the dark bill and legs, general whitishness, and the mottled area on the top of the

head and back of the neck. On December 31, the bird was viewed at close range by participants in the Christmas bird count of the Audubon Society of the District of Columbia, led by Dr. John W. Aldrich. The consensus of opinion of the many observers was that the bird was an immature Snow Goose. However, on January 31, 1945, Dr. Paul Bartsch, of the National Museum, found the skeleton of the bird, which apparently had died of starvation and had then been devoured by crows or some other scavenger. The wing feathers were still on the skeleton and when the wings were compared with specimens in the National Museum they were found to be typical of the Blue Goose. After careful study of photographs taken of the bird in life, by R. T. Peterson and Dr. John W. Aldrich, it was noted that the bird was similar to the Blue Goose on the wings and like the Snow Goose on the under parts and neck. It is now concluded that it was a hybrid between these two species.—
DAN EMERY, 4600 49th Street, N. W., Washington, D. C.

Apparent death of a Blue Jay from Toxoplasmosis.—On May 2, 1944, Dr. R. B. Dienst of Augusta brought to the writer a male Florida Blue Jay (*Cyanocitta cristata cristata*) which dropped dead from a tree at his home during the course of the doctor's breakfast. As the bird was fresh and in fair plumage it was skinned and the skin preserved. The carcase was then examined to determine the probable cause of death.

The bird was emaciated and generally in poor condition. Numerous oval, cream-colored lesions, which contrasted sharply with the purplish normal tissue, were scattered throughout the skeletal muscles though more numerous in the breast. A cube of pectoral muscle containing lesions was preserved for sectioning and staining. The internal organs were free from parasites and showed no gross lesions. A smear of heart's blood stained with Wright's stain was negative for parasites. No smears were made of the liver, spleen or lungs.

The section of pectoral muscle shows numerous grayish-yellow foci of necrosis, the largest of which was 2-3 mm. in diameter. The necrosis is coagulative in type and involves the muscle cells primarily. Around the margins of these lesions there is a dense leukocytic infiltrate composed of macrophages, eosinophilic polymorphonuclear leukocytes, lymphocytes and round cells resembling plasma cells. Inwardly, many of the macrophages contain ingested parasites, often in large numbers, which are identified as *Toxoplasma*. Multinucleated giant cells are present but are not actively parasitic. Some of the parasites are extracellular, apparently due to rupture of the containing phagocyte. Rarely an organism is observed within a capillary. The centers of the largest lesions are completely necrotic and all tissues are disintegrating.

Throughout the muscle there are microscopic foci of leukocytic infiltration, usually perivascular in position. Organisms are not found in these areas.

According to Herman [Bird-Banding, 15 (3): 89-112, 1944], infections with *Toxoplasma* have been reported in 14 species of North American birds, including a questionable infection in the Blue Jay. Also, according to the same author, the pathogenicity of *Toxoplasma* for birds is not known. In the writer's opinion, the *Toxoplasma* infection undoubtedly caused the death of the bird discussed above.—J. FRED DENTON, University of Georgia School of Medicine, Augusta, Georgia.

White Pelican in New York State.—On April 21, 1945, a White Pelican (*Pelecanus erythrorhynchos*) was seen by Mr. Sidney Wilkin of Rochester, New York, on a marsh at Shore Acres, Monroe County, New York. The marsh is about 20 acres in extent, drains into Lake Ontario, and is north of the village of Hilton. The following

day the bird was found dead by Mr. Wilkin at the edge of the marsh. It had been shot and left by someone unknown. The bird was turned over to New York Conservation Department officers and has now been placed in the New York State Museum collection. The bird was a female in excellent breeding-plumage condition and contained eggs. It weighed 11½ pounds, had a wing-spread of 97 inches, and a length of 54 inches. It was examined in the flesh by both authors of this note.—
GORDON M. MEADE, M.D., Strong Memorial Hospital, Rochester, New York, AND CLAYTON B. SEAGEARS, Supt. of Conservation Education, Albany, New York.

The sleeping habit of the Willow Ptarmigan.—A frequent statement regarding the Willow Ptarmigan (*Lagopus lagopus*) is that in winter when it goes to roost it drops from flight into the snow, completely burying itself and leaving no tracks that might lead predators to it. E. W. Nelson made this observation years ago in Alaska, and it is given also by Sandys and Van Dyke in their book, 'Upland Game Birds.' Bent (U. S. Nat. Mus. Bull., 162: 194, 1932) in writing on Allen's Ptarmigan of Newfoundland, quotes J. R. Whitaker as stating that they roost in a shallow scratching in the snow and are frequently buried by drifts and imprisoned to their death. On Southampton Island, Sutton records the Willow Ptarmigan as roosting and feeding in the same area without attempt at concealment. One night seven slept for the night in seven consecutive footprints of his track across the snow.

The observation of Sutton that these birds are not always so cautious as Nelson and others state is corroborated in recent correspondence with Mr. H. W. Betts of Dawson, Yukon Territory. This formerly prominent place is now somewhat of a 'ghost' town, where, to quote from Mr. Betts' communication of February 14, 1945, "the townsite presents many vacant lots which are, almost without exception, overgrown with willows of various heights. Among these willows there is a small covey of five Willow Ptarmigan that I have had under observation on six different occasions. They are delightfully tame and I have approached within about fourteen feet without disturbing them. Sometimes they feed six or eight feet above the snow in the willows, but as you know, their perching is somewhat precarious owing to their wonderfully padded feet, *a la* Arctic Hare. Mostly, however, they browse on the short willows, and when they come to a single, upright shoot, with buds out of reach, they stretch head and neck and jump. I located them last night well towards evening and watched in the hope of prying upon them when they retired for the night, something that I had hitherto been unable to accomplish. Luckily, I was just in time to watch this. They started numerous false beds, scratching them three or four inches down in the snow, which was about fifteen inches deep, and then abandoning them. One that I watched particularly made two false starts and, then, leaving the second hole, tunnelled under the snow for about eighteen inches, and finally made a long, deep hole which had a roof over it, and there stayed the night. This I verified this morning, the temperature being 42° below zero (Fahr.) at 9:00 a. m. The excavating was very rapid, and they make the snow fly behind them in a veritable little cascade. This morning I only succeeded in locating four definite roosts, but am satisfied the fifth was quite near. Tracks were everywhere, and in every instance the birds had deliberately walked to the sleeping place, not one flying into the snow."

In a later communication in response to my inquiry, Mr. Betts writes that the snow at the time was loose and powdery, and that it usually remains in this condition through the winter, due to dry atmosphere and steady cold. On one occasion, like Sutton, he found where two out of five Willow Ptarmigan had slept for the night in two of his footprints left in the soft snow.—
ALEXANDER Wetmore, Smithsonian Institution, Washington, D. C.

First nesting of Forster's Tern in South Carolina.—While examining some oölogical specimens recently, the writer made the discovery of an omission which is being rectified herewith. Early in January, 1937, he was given a set of eggs of *Sterna forsteri* by Dr. Eugene E. Murphey, M.D., of Augusta, Ga., which had been collected on Vessel Reef, Bull's Bay, S. C. on June 24, 1904. It is the first record of the nesting of that species in South Carolina. This fact should have been recorded before, as intimated above, and the writer was under the impression that it had been, but search of the literature reveals the lack of it. Some details of the matter are of interest.

The eggs were found by a cousin of Dr. Murphey's (Elwood Murphey) who was visiting the South Carolina coast with Dr. M. T. Cleckley of Augusta. He pointed out the eggs to Cleckley who recognized them for what they were, and knowing their rarity, he collected and prepared them. On his original data now in the writer's possession, Cleckley wrote that the identification of the eggs was doubted by Arthur T. Wayne of Mt. Pleasant, S. C. for many years the well known ornithologist of this area. They were submitted to the Smithsonian Institution at Washington where the identification was confirmed. Dr. Murphey adds that: "My cousin Elwood blundered on to the nest with its eggs and called them to Cleckley's attention who immediately collected them for he knew what they were by reason of his great familiarity with eggs as such."

The eggs number three and were laid in a "slight depression in the sand, on a small elevation." Vessel Reef has since disappeared by action of storm tides. Bull's Bay has other tern colonies today, consisting of Royal Terns (*Thalasseus m. maximus*), a few Cabot's Terns (*T. sandvicensis acuflavida*), and Caspian Terns (*Hydroprogne caspia*), many Least Terns (*Sterna a. antillarum*) and an occasional Gull-billed Tern (*Gelochelidon nilotica aranea*). Anyone familiar with the eggs of these birds will of course, understand how unlike they are from those of *S. forsteri*. Apparently this recording of a first breeding record comes literally under the heading of better late than never!—ALEXANDER SPRUNT, JR., *The Crescent, Charleston 50, S. C.*

Harlequin Duck on the Texas coast.—On January 14, 1945, while traveling north on Highway 35, six miles from Rockport, Texas, I saw a small raft of ducks to the left (Copano Bay side) of the rock breakwater on the south end of the Copano Causeway. They were about 12 feet from shore and about 50 feet from where I stopped my car. Twelve of the ducks were American Golden-eyes. White markings on the face of one small duck immediately attracted my attention and very quickly I saw that a male and female Harlequin Duck (*Histrionicus histrionicus*) were present. I was so close that glasses were not actually necessary, but I put the glasses on them (Zeiss 8 X 40) and compared their markings at the same time with the figure in Peterson's 'A Field Guide to the Birds.' The identification was unmistakable. I kept them under observation for about 20 minutes and afterwards continued up the highway but returned about two hours later. The ducks had not left the vicinity and they were watched again for about ten minutes. They have not been seen since. On January 30, Mr. Ralph Friedman, of New York City, who came to Rockport with Dr. Fleisher, of Brooklyn College, to observe birds, told me that on the previous day he had identified a Harlequin Duck on the Aransas Wildlife Refuge, near Austwell, Texas. He felt rather sure of the identification but nevertheless felt that it was "too fantastic" and therefore had scarcely known what to think about it.

Dr. Harry C. Oberholser has informed me that the Eastern Harlequin Duck (*H. h. histrionicus*) has been recorded as far south as Florida. According to Musgrove and Musgrove ('Waterfowl in Iowa,' State Conservation Commission, Des Moines:

65, 1943), the Western Harlequin Duck (*H. h. pacificus*) is a rare straggler in Iowa. Dr. Oberholser has written me that the species has been recorded in Colorado and he is of the opinion that those I saw also belonged to the western subspecies. This is the first time I have seen the Harlequin Duck here during nine years of daily observation and, so far as I can ascertain, it is the first record from Texas.—CONGER N. HAGAR, Rockport, Texas.

Canada Geese nesting in Maine.—There is a rather widespread belief among sportsmen and bird lovers that the Canada Goose (*Branta canadensis canadensis*) regularly breeds in limited numbers throughout Maine, despite the fact that there appear to be no references in the literature relative to such breeding. Actually there are but two Maine records known to the writer that could be considered as reasonably authentic instances of nesting by wild geese.

In the lower Kennebec River valley of south-central Maine, and in the coastal portion of Washington County in the extreme eastern part of the state, there have been frequent reports during the past decade of nests or broods of this species. All reports that were investigated, however, have been found to pertain to the nesting of released or escaped semi-domesticated birds. A number of releases of pen-reared geese have been made in the vicinity of Lubec, in Washington County, by a sportsman who for several years maintained a small waterfowl sanctuary. Moreover, from time to time, wing-clipped birds escaped from the sanctuary and occasionally nested in the general vicinity. Similar dispersals have occurred in southern and central Maine from pen-reared stock.

The first authentic record of breeding in this state by strictly wild geese was apparently in 1939 in the Gilman Falls section of Old Town, Penobscot County. The nesting area was in a meadow flowage on Pushaw Stream, surrounded by open woods and farmland. Local residents found the nest and reported it to Deputy Game Warden C. M. Chaples. It was said to have been located at the edge of a small clump of maples near the water and to have contained five eggs. The nesting attempt was a failure as a poacher shot the female with a rifle. Warden Chaples arrested the law violator and obtained a conviction in court. The specimen was brought to the laboratory of the Maine Cooperative Wildlife Research Unit for examination, and partly developed eggs were found in the ovary. The bird was not banded, and since the male had been observed by Warden Chaples at very close range with no band being apparent, it seems likely that these birds were of wild strain.

The other record occurred in 1944 at Chemquasabamticook Lake (known locally as Ross Lake) in northwestern Piscataquis County, about 20 miles from the Quebec border. George J. Stobie, Commissioner of the Maine Department of Inland Fisheries and Game, received reports of a brood of goslings being seen at that body of water and investigated early in July. The area is very remote and Stobie was flown in by Warden Pilot William Turgeon. As the plane circled over the water at a low altitude, two broods of geese were seen, each accompanied by both parents. The plane was landed and the lake was explored by boat. The observers were able to relocate only one brood, but this—consisting of four young in downy plumage—was watched for several minutes at a distance of about 50 feet. The young were attended by both adults and the family was in a small cove of the lake. Although it was impossible to detect the presence or absence of bands on the adults, the occurrence of the birds at this wilderness lake so far removed from any area where captive geese are known to have been released would constitute rather strong circumstantial evidence of breeding by wild birds.

The writer is indebted to Commissioner George J. Stobie and Deputy Game Warden C. M. Chaples for the details of these breeding records.—HOWARD L. MENDALL, *Maine Cooperative Wildlife Research Unit, Orono, Maine.*

Costa Rican Sparrow near the Canal Zone.—According to Chapman ('Post-glacial History of *Zonotrichia capensis*', Bull. Am. Mus. Nat. Hist., 77: 381-438, 1940), the present known mainland range of the Neotropical White-throated Sparrow (*Zonotrichia capensis*) begins in southern México and Guatemala, skips to Costa Rica and western Panamá, skips again to Colombia, and thence, in favorable unforested localities, to Tierra del Fuego. Throughout its range the bird seeks a climate with comparatively low temperatures and is consequently found only in uplands or territory influenced by the Humboldt Current. In the Republic of Panamá the bird is known from the western part as far east as Santa Fé, which is 5000 feet above sea level.

On April 22, 1942, at Chamé, Rep. de Panamá, 25 miles southwest of the Canal Zone, at an altitude of 1600 feet, there was a single sparrow which I described as follows in correspondence to Dr. James P. Chapin: "Its head was black and white striped with the chin and upper throat white. Around its neck was a collar of cinnamon-buff or red-brown. The rest of the upperparts and tail were brown with black streaks." These observations were made with 8 \times 30-power binoculars at a distance of fifty feet. The habitat was an isolated rocky, sedge-covered hilltop which projected above the coastal plain like an overturned teacup on a table top. The summit is bald and reaches an altitude of 1767 feet above the Pacific Ocean. Below 1300 feet, these 'mountains' are blanketed with thick dry forest. It was above this false timberline, where only sedges and occasional stunted shrubs grow, that the bird was seen all alone among the rocks in a cold wind. Dr. Chapin replied that it was undoubtedly *Z. capensis* and expressed surprise that it was found below "3000 or 4000 feet."

Having no gun, I was unable to collect the specimen to determine its race. However, since *Z. capensis costaricensis* is the only subspecies known to occur between Costa Rica and Colombia, the bird would most likely be an individual of this race. The Chamé 'Mountains,' on the Pacific Coast, are 72 miles east of cordilleran Santa Fé, the previous easternmost record for the species in the Republic de Panamá.—GERALD ROGERS, CAPT., A. C., Oklahoma City, Oklahoma.

English Sparrow anting.—While inspecting the nesting activities of the waterfowl in the National Zoological Park, I observed a Flicker (*Colaptes auratus*) probing an ant hill. As the bird thrust its beak far down into the opening of the hill, and withdrew it, and again extended its beak downward in the nest of ants, many ants swarmed about in excitement upon the ground. It was a rich feeding ground for the flicker. As I stood six feet from the bird, watching this feeding operation, a young English Sparrow (*Passer domesticus domesticus*) which appeared to have been on the wing only a few days, flew down to the ant hill, and with much excitement dusted itself among the ants. Then I suddenly realized that I was witnessing the act of anting by a member of the Ploceidae.—MALCOLM DAVIS, *National Zoological Park, Washington, D. C.*

RECENT LITERATURE

Common diseases of birds.¹—Mr. Enrique Avila, of the staff of the Peruvian National Guano Administration, has completed four years of graduate study at the University of Wisconsin. In August, 1945, he is scheduled to return to Perú and to devote his labors to the conservation and development of the great hordes of guano birds, a major natural resource of his country.

Mr. Avila has recently published a non-technical but comprehensive account of diseases of wild birds, with particular reference to those having agricultural significance or capable of transmission to man. In successive sections of the paper he discusses diseases caused by bacteria, protozoa, fungi, ectoparasites, and the several groups of organisms called worms.

Here we learn that a malady indistinguishable from equine encephalomyelitis has a high incidence among birds, and that the notorious "duck sickness," formerly ascribed to botulism, is in reality a form of this "sleeping sickness." Psittacosis, more familiar to ornithologists, is common to a large variety of birds in addition to parrots. It can be communicated by way of many different secretions and exuviae, and its mortality among human beings is extremely high (30–40 per cent). True botulism has been described in more than 60 species of birds. Avian tetanus, diphtheria, tuberculosis, cholera, erysipelas, malaria, and the fungus infection known as aspergillosis are also widely prevalent. Rabies and undulant fever have been induced experimentally, even though they have not yet been found in nature. Tularemia, so-called because it was first recognized in Tulare County, California (although some of our British colleagues insist on forcing upon it the pseudo-Greek spelling "tularaemia"), is another malady with important human bearings. Furthermore, starlings in England have been charged with being vectors of foot-and-mouth disease of cattle, while certain other birds can carry and perhaps distribute the organisms of anthrax, coccidiosis and similar plagues.

The author briefly refers to the extraordinary number of avian ectoparasites, of which more than 200 species have been found in the relatively small area of the United States east of the Mississippi River. He remarks, however, that both external and internal parasites are a normal characteristic of most wild animals and that only rarely does such infestation cause the death of a large proportion of the hosts.—R. C. MURPHY.

The life of the hummingbirds.²—Jacques Berlioz is undoubtedly the world's authority on hummingbirds and it is to be hoped that he will soon give us a complete and much needed revision of the family, to bring up to date the work of the late Eugene Simon, our common friend and inspirer, whose magnificent collection has been bequeathed to him. The present volume, however, is not a technical study, but a general account of the hummingbirds for laymen interested in these lovely creatures. It is significant and comforting to note that commercial publishers have found fit to ask the author for such a book and to hear that it had a successful sale in present-day France. Berlioz writes with the clarity and elegance of the French naturalists of the past two centuries. He knows how to make science smile.

During his extensive travels, he has also taken excellent photographs of hummingbirds' habitats throughout the Americas. Some of them illustrate the work, as well as two charming colored plates and several line drawings after his own sketches.

¹ AVILA, ENRIQUE. 'Enfermedades más corrientes entre las aves silvestres.' *Boletín de la Compañía Administradora del Guano*, 21: 87–94. Lima, April, 1945.

² BERLIOZ, JACQUES. 'La Vie des Colibris.' Pp. 1–198, pl. 1–10, 5 figs. *Histoires Naturelles*, 4. Gallimard, Paris, 1944.

In the first part of the book the author exposes the biology of the birds: general characteristics, locomotion, diet and feeding, nesting and breeding. In the second part, he studies the different habitats, geographical distribution, and migrations. A short appendix is dedicated to the hummers in captivity. More technical ornithologists would be well advised to follow Berlioz's example and to put their experience at the disposal of the general public. The author of the present work deserves our congratulations for the excellent way in which he has succeeded in fulfilling the wishes of enlightened publishers.—JEAN DELACOUR.

Bird migration.¹—In one of the four parts of a book dedicated to animal migrations and published for the benefit of the reading public, Jacques Berlioz has discussed bird migration in his usually precise, informative and attractive style. In five chapters, he reviews the definition and origin of bird migration, its general characters, variability and different influences, and migrations in boreal, austral and intertropical regions. In the last one, he gives his conclusions, which are that bird migrations are essentially due to the quest for food and to geographical considerations linked to the modifications that have taken place on the earth, particularly after glaciation periods.

The other three parts of the work treat the migration of insects (L. Chapard), fish (L. Bertin) and mammals (P. Laurent) with a remarkable preface by Prof. L. Cuenot.—JEAN DELACOUR.

Modern bird study.²—The present volume has as its foundation a series of lectures given by the author at the Lowell Institute in early 1944 and here revised and expanded for the reading public. It gives a concise account of various phases of modern bird study with a broad glimpse of the subject that should acquaint the layman with many aspects of ornithology with which he is likely to be entirely unfamiliar. It is in no sense a technical manual although the workers in the ornithological field will appreciate the fact that the subjects discussed are frequently highly technical. Mr. Griscom has simplified his statements in a readable style for the benefit of the general reader.

The broad aims and procedures of field observation as they have altered over the years make a good introduction. The intelligence and adaptability of birds are next discussed. Bird migration and general distribution and some of the special problems of distribution in different parts of the Americas are discussed in some detail, and the principles underlying modern practices of classification comprise the concluding chapter.

While these are the main headings under which the text is placed, the discussions are expanded to bring in outlying topics that are pertinent. There are few details of ornithological study that may be considered effectively alone and there are always radiating lines of interrelationship. The author has covered a great deal of ground and still kept the account running smoothly. Numerous concrete examples are cited and a variety of anecdote is added to lighten the story. A very brief list of references is given at the close of each chapter which might have been expanded without detriment but rather with some advantage to the reader who might wish to pursue certain topics further. Various of the works cited will, however, supply some of the additional references needed.

The book may be recommended to a wide public, especially to people who may sometimes wonder what an ornithologist does with his time.—J. T. ZIMMER.

¹ BERLIOZ, J. 'Les Migrations d'Oiseaux.' Pp. 91-162, in *Les Migrations Animales*. L'Avenir de la Science, 17, Gallimard, Paris, 1942.

² GRISCOM, LUDLOW. 'Modern Bird Study.' Demy 8vo, X + 190, 15 pls., 10 figs., June 1, 1945. Harvard University Press, Cambridge, Mass. Price \$2.50.

Galápagos Finches.¹—Ever since Darwin's historic visit to the Galápagos Islands in 1835, the Galápagos finches have furnished an extremely fertile field for ornithological study and speculation. At intervals there have been accounts of the islands and their bird life with the focal point of the studies centered in these birds. None of the reports has been exhaustive nor does the present account purport to be such, but there are many features brought out by Mr. Lack that add a great deal to our knowledge of the subject.

The author visited the archipelago in late 1938 and early 1939 and studied these finches in the field on various of the islands. A number of the birds of four species were taken to California for investigations in the aviary since their removal to England was found to be impractical. A large number of previously collected specimens in various collections in America and in the British Museum were examined. Mr. Lack's conclusions are, therefore, based on first-hand information of wide extent.

The first part of the report deals somewhat briefly with the classification of these birds in which some new proposals are offered, although Swarth's classification is, in the main, found acceptable. Several groups are called 'superspecies' although their components are not consistently maintained as species in all references to them; in some places binomials are used but in others, trinomials, which is a little confusing. Owing to the extensive variability of some of these birds and the overlap of characters, some specimens have been impossible to identify with certainty, and intermediates and variants have been assigned to different species by different authors or, in some cases, named as distinct. Some of this confusion still remains. In the curious case of *Geospiza magnirostris*, the three original specimens are larger than any that have been taken since Darwin's time and Lack supposes that an evolutionary change may have taken place in the intervening years.

The breeding behavior of nine species was studied in the field with some interesting experiments performed with mounted specimens. There was found to be great similarity in the different genera and species not only in respect to this behavior but also in songs and call-notes. A limited correlation, only, was found between feeding habits and differences in the bill. Gifford's earlier discovery was confirmed of the use, by *Cactospiza pallida*, of a thorn or twig for probing crevices in search of insects.

In *Geospiza magnirostris* and *G. fortis*, no differences of habitat, food, feeding habits, nest site, or breeding season were discovered although the species differ only in general size and relative size of the bill and live in close association without interbreeding. Other less exact cases are mentioned. Lack concludes that habitat distinctions have been of importance in speciation of these birds in only a few cases. Certain possible niches on the islands are still unfilled. No species is isolated from another by differences in breeding season but there is a difference of breeding times on the coast and in the interior due to differences in the incidence of the rainy season.

Some males were found to breed in a partially or completely streaked plumage, but while some of these individuals may have been birds of the year, there is a possibility that this type of plumage may be the fully adult dress for certain others in the genera *Platyspiza* and *Camarkynchus*. Lack thus believes, with Swarth, that this group of finches is in process of losing the black plumage.

Since the coloration of so many members of the group is the same uniform black in the male sex, recognition of the various species by each other is principally by the size and shape of the bill. Nevertheless, there is considerable variation in bill

¹ LACK, DAVID. 'The Galapagos Finches (Geospizinae) A Study in Variation.' Occ. Papers California Acad. Sci., No. 21, 4to, VII + 159, frontisp. (map), pls. 1-4, figs. 1-26, San Francisco, May 30, 1945.

measurement and in the amount of variation, itself, in different island populations of the same species. Some of the variants have been given distinctive names but others are considered of lesser significance. Each island population is considered to have evolved independently but to have been subject to periodic disturbance through inter-island wandering. Species probably originated principally through geographically isolated races that later met and kept distinct, although some may be of hybrid origin. Changes in sea level at various periods have made inter-island connections and separations inconstant, and this partial and temporary isolation and sporadic intercommunication have supplied the factor of greatest importance in the speciation of these birds. If any connection with the mainland ever occurred, it was before the avian colonization.

If, as is maintained, the genus *Tiaris* [*Euetheia*] is the probable ancestral source of these finches, *Geospiza fuliginosa* seems to be the nearest approach to the primitive stock and *Certhidea* the farthest removed—probably the first to split away from the remainder.

Many other facts and conclusions are brought out in this lucid and instructive paper—the broadest account that has appeared to date on this most interesting group of birds.—J. T. ZIMMER.

A monograph of the shrikes of the genus *Lanius*.¹—One of the wonders of the second World War is that while so many branches of human activity had just disappeared from Europe along with the old way of living, a few seem to have miraculously survived. Ornithology appears to be one of the fortunate exceptions. L'Oiseau, which I founded in 1920 and edited until 1940, has come out regularly, if reduced in bulk, throughout the war under the devoted care of Messrs. Berlioz, Jabouille, Rapine, Legendre and a few others. Even a few special works on birds have been published and the present monograph is the most important of them. That it was printed at Rouen in 1943–1944, a tragic period during which the greatest part of this wonderful old city was destroyed by bombs, needs no comment. Georges Olivier has been for many years particularly interested in shrikes and has accumulated data and information on all species of *Lanius*. I remember discussing the present book with him as we were walking through the park at Clères, then the mecca of ornithologists, today empty and devastated. The work was begun a few years before the war started and completed in September, 1943. After an excellent preface by Jacques Berlioz and foreword by the author, comes the first part consisting of an exhaustive study of the general characteristics of the family and genus. The classification adopted by the author is not revolutionary and follows in general that of G. Schiebel [J. für Orn., 54 (2): 161–219, 1906]. Fortunately he does not accept any of the unhappy generic splitting proposed and accepted by several authors, nor does he deem it necessary to describe new forms. He recognizes four groups: A.—a primitive group composed of seven species: *cristatus*, *isabellinus*, *tigrinus*, *collurio*, *gubernator*, *colluriooides*, and *vittatus*. B.—*Excubitor* group with four species: *bucephalus*, *excubitor*, *sphenocerus*, and *ludovicianus*. C.—Indo-Malayan group, composed of *minor* and *schach*, but in which *L. validirostris*, from the mountains of Mindoro and Luzon should have been included as a valid species. D.—African group, of nine species: *excubitorius*, *cabanisi*, *collaris*, *newtoni*, *mackinnoni*, *dorsalis*, *nubicus*, *senator* and *sousae*. The relationship of these groups and species is discussed at length and a very good phyletic tree of all recognized forms is given. Much importance is rightly stressed in juvenile plumages. In the second and much longer part of the

¹ OLIVIER, GEORGES. 'Monographie des Pies-Grièches du genre *Lanius*. Pp. 1–326, 17 plates. Lecerf, Rouen, 1944.

work, all species and subspecies are listed, with references to bibliography and iconography, detailed descriptions of adult male, female, immature and chick, field characters, distribution, nesting and habits. Many maps and a number of photographs and colored plates (8) illustrate this most useful, thorough and well conceived revision. An exhaustive bibliography of the subject follows, with some corrigenda and addenda. The whole work is very satisfactory and I have no criticism to offer, with the exception of that concerning *L. validirostris* and perhaps also of the names given to the two northern forms related to *L. schach*. I am not yet convinced that *nipalensis* should replace *tephronotus*, and I still think it might be considered a separate species. More research remains to be carried out before a safe conclusion can be reached.

The book is surprisingly well produced. The paper is good and the plates are carefully printed. It is a monument to the skill, knowledge and courage of Georges Olivier, as well as to the ingenuity of the printers.—JEAN DELACOUR.

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NOTES AND NEWS

Word has been received of the death of George Willett, Vice-President of the American Ornithologists' Union, on August 2, this year.

Information has come indirectly that the general collection of birdskins at the Berlin Museum is intact as is the library, but the mounted birds, presumably including the Lichtenstein and Cabanis material, were destroyed. Dr. Erwin Stresemann has resumed work at the Museum but Dr. Oskar Heinroth died of pneumonia on May 31, 1945. The Museum für Naturkunde was destroyed.

At Bonn, Dr. von Jordans has written, the zoological collections of the Alexander Koenig Museum escaped. Those of the Senckenbergian Museum at Frankfort am Main, where Rüppell's types and the Berlepsch and Erlanger collections were housed, are of uncertain fate. Most of the material is said to be safe, but one [unspecified] great ornithological collection was destroyed.

In Munich, the fossil vertebrates were destroyed and since the general collections were kept in the same building, they may have met the same fate.

The Congo Museum at Tervuren, Belgium, was nearly struck but the 'near miss' left the bird collections undamaged.

The Editor again must express his deep appreciation of the generous assistance given by Dr. A. J. C. Vaurie and Mrs. Vaurie, of New York City, in the preparation of the lists of ornithological references given through the year under the heading of 'Periodical Literature.'

CORRESPONDENCE

IDENTITY OF CATESBY'S TROPIC-BIRD

EDITOR OF 'THE AUK':—In the January (1945) number of 'The Auk' pp. 137-139, McAtee has attempted to show that the tropic-bird *Phaethon catesbyi* Brandt, based on Catesby's description and plate ('Nat. Hist. Carolina, Florida and the Bahama Is.,' 2, appendix: 14, pl. 14, 1731 [= 1738]) is in reality *P. aethereus*. It seems to me, however, that both plate and description agree better with *P. lepturus*.

In the first place, Catesby noted that the "bird was about the size of a partridge" (undoubtedly *Perdix perdix* which Catesby elsewhere calls the "common partridge" and uses as a basis of comparison), a statement that would seem to pertain to the smaller species. Incidentally, Catesby describes the Ruffed Grouse (*Bonasa umbellus*) as "a third part bigger than a common Partridge" (*tom. cit.*, p. 1). Secondly, he states that, apart from the black eye-stripe, "three or four of the large quill feathers, towards their ends, are black, tipped with white; all the rest of the bird is white, except the back, which is variegated with curved lines of black." The adult *P. lepturus* has a black band extending from the bend of the wing to the secondaries and another on the tertials. These converge on the rump when the wings are folded. The plate does not show the narrow black barring characteristic of *aethereus*. The back is white in the copy before me, not "fulvous" as in that seen by McAtee. A few lunate, dusky spots on the mantle are of questionable significance, but immature specimens of *lepturus* have such markings. I suspect that both Catesby's description and illustration were based on sketches of, and notes on, the examples that he had previously shot on Bermuda.

Finally, there is no definite record of *P. aethereus* from Bermuda, where it was reported as having been seen by A. H. Verrill,—a record that needs substantiation. The species is correctly placed in the Hypothetical List by Bradley, Mowbray, and Eaton in their "A list of the birds recorded from the Bermudas," Proc. Boston Soc. Nat. Hist., 39 (no. 8): 361, 1931. Furthermore, *P. aethereus* is unknown from Puerto Rico, Hispaniola and Cuba, and records from Jamaica and the Bahamas are most unsatisfactory. The Yellow-billed Tropic-bird (*P. lepturus*) is an abundant summer resident (February 2—December 25) in the Bermuda Islands (*tom. cit.*, p. 297).—JAMES BOND, Academy of Natural Sciences, Philadelphia, Pennsylvania.

BENT'S 'LIFE HISTORIES OF NORTH AMERICAN BIRDS'

EDITOR OF 'THE AUK':—Your readers may be interested to know that satisfactory progress is being made in producing manuscript for future Bulletins on the Life Histories of North American Birds. The material for four volumes, including all the birds on the A. O. U. Check-List from the jays to the vireos, has been in Washington for a long time, awaiting publication after the war. Two volumes on the wood warblers are now nearly completed, awaiting a few contributions from others. I am now starting work on the next volume, to include the birds from the weaver finches to the tanagers, and am taking this opportunity to solicit contributions of notes on habits and photographs relating to birds in the three families, Ploceidae, Icteridae and Thraupidae. Previous contributions have been very helpful, and I hope they will continue.

A. C. BENT, Taunton, Mass.

OBITUARIES

MILLARD CLAYTON ERNSBERGER, an Associate of the American Ornithologists' Union for five years, died at Ithaca, N. Y., January 25, 1940, in his 78th year. He was the son of Daniel W. and Hannah (Warne) Ernsberger and was born at Varick, Seneca Co., N. Y., June 12, 1862. He graduated from the University of Rochester with the degree of A.B. in 1888 and from Sibley College, Cornell University, with the degree of M.E. in 1908. Ernsberger was admitted to the bar in 1891 and practiced law for six years in New York City. After two years spent as manager of the illustrating departments of the New York Tribune and eight years as draftsman and designing engineer with MacIntosh, Seymour & Co., builders of steam engines, at Auburn, N. Y., he returned to Cornell as Assistant and Instructor in Power Engineering in Sibley College. He served as Professor of Mechanical Engineering at the University of Rochester from 1909 to 1921, and on April 30 of the latter year was appointed Professor of Heat-Power Engineering at Cornell.

Prof. Ernsberger was a member of the American Society of Mechanical Engineers and was elected an Associate of the A. O. U. in 1934. He did not contribute to 'The Auk' and apparently published little if anything on birds, but this is not surprising when it is recalled that he was 72 when he joined the Union. He was unmarried.—T. S. PALMER.

GUSTAVE KOHN, who was elected to associate membership of the Union in 1886, was born in New Orleans, Louisiana, March 18, 1837, and died in Neuilly, France, September 7, 1906. His early education was received in New Orleans, and later his studies were extended in France.

He was keenly interested in natural history subjects, and was quite active in making collections, especially of birds and mammals, not only for himself but for others who needed material from Louisiana. He secured a series of fox squirrels for Dr. J. A. Allen, and sent his collection of turtles to Doctor Baur of Clark University, Worcester, Massachusetts, who was planning a monograph on the subject. In working over this material, Doctor Baur found a well-recognized new form of map turtle which he described, and in honor of Kohn named it *Malaclemmys kohnii*. The U. S. Biological Survey received numbers of specimens as gifts or exchange from him, and always was glad to assist in the identification of material of which he was in doubt. Later he gave his rather large and valuable collection to Tulane University. The city directories gave his vocation as that of a capitalist.

Kohn was a quiet, unassuming man of pleasant approach, attentive and interested while in conversation with friends on subjects of mutual understanding. After our several meetings in New Orleans, and time went on, we often were in correspondence touching on some subject that was of mutual interest.

During the autumnal migration, before sale was prohibited, he frequently visited the French market and noted the numbers and species of song birds that were there on sale. In a letter dated October 22, 1890, he reported: "I saw in the game market the day before yesterday, hundreds of dozens of wood thrushes for sale, also quite a number of rose breasted grosbeaks, scarlet tanagers, a few summer red birds, and some bunches of olive back thrushes. All of these birds were extremely fat, and were killed near Mandeville on the north side of Lake Pontchartrain. They were selling at one dollar a dozen retail." In a letter dated October 29, 1890, he gives this information: "The slaughter of the wood thrushes stopped a few days after my letter was sent. A cold spell drove the birds further south, and very few birds are

now to be seen in market. We shall not see them any more for sale until October, 1891."

Kohn was interested in learning what species were to be found in the market, their season, their abundance and which seemed to be the favorite morsel of food. In our talks he gave me interesting information on this subject new to me. It seems almost a perversion when a markedly insectivorous species, on its southern migration feeds almost entirely on the fruit of the magnolia, bayberry (*Myrica*) and similar species and in a short time becomes obese. Among the earlier species to reach the market were the Kingbirds (Gros grasset) and Red-eyed Vireo (Petit grasset) which were fat and sold for one dollar a dozen. Before the Red-eyed Vireos and thrushes leave the north, sometimes they will eat the berries of the spice bush or sassafras in case they are found ripe, both of which have a similar flavor to that of the magnolia. The Wood Thrush (Caille de Laurier) seemed to be a marked favorite, and at times sold as high as two dollars a dozen. In winter the Tree Swallow (Cerier) fed largely on the wax bayberry, and became very fat, selling in plucked dozens for fifty cents. The Cedar Waxwing (Murier) and Robin (Grive) also were winter species, but unlike the Wood Thrush were not so fat and brought seventy-five cents only.—A. K. FISHER.

ROBERT STATHAM WILLIAMS had been an Associate of the A. O. U. for 59 years when he died in Minneapolis, Minnesota, on March 13, 1945. He was an Honorary Associate for a number of years before his death. He was born in Minneapolis, May 6, 1859, the son of Thomas Hale Williams, founder and first librarian of the Minneapolis Athenaeum which was the forerunner of the Minneapolis Public Library. It was through the influence of Thomas Hale Williams that Dr. Kirby Spencer, a dentist, bequeathed to the Athenaeum his considerable fortune which made possible the acquisition of the large collection of art, technical, and scientific works present in the Public Library today, since Dr. Spencer stipulated in his bequest that no religious work nor fiction should be purchased with the money.

Robert was educated in the Minneapolis High School and University of Minnesota though he did not graduate from either. He was early interested in natural history, with birds predominating at first, botany later. He was an active and loyal member of a small group of High School and University students associated for several years as 'The Young Naturalists' (see *The Scientific Monthly*, Vol. 54, January, March, and April, 1942, for articles by Dr. C. Judson Herrick). In 1879 he went to Great Falls, Montana, where he was for a time sheep herder, mail carrier along the Mussel Shell River in the Belt Mountains, and librarian in the Great Falls library. His growing interest in botany led to his collecting and preserving those species that especially appealed to him, and these he sent to Professor Eaton at Yale. It has been said that it was Professor Eaton who directed his attention to mosses which, as it turned out, became his life work. After several years collecting in Montana and spending part of 1898-1899 in the Yukon region in Alaska, he became connected with the New York Botanical Garden as Research Associate in Bryology, working under Dr. and Mrs. Britton. From this time on his major interest was the study of mosses. This period was from 1899 to 1940 when he retired from the Garden. During this time he made several extensive collecting trips in the interest of the Botanical Garden. In 1901-1902 he crossed the Andes in Bolivia with a party exploring for rubber and mines; from October, 1903, to August, 1905, he was in the Philippines, and in 1908 in Panamá. While mosses were the chief object, he collected at the same time many specimens of higher plants which were deposited in the Botanical Garden herbarium. A considerable number of these were new to science and several

bear his name. Collections of mosses that were sent to the Botanical Garden for identification from far and wide were referred to Williams for study and naming. In the course of this work he published some 55 papers, describing 165 new species and nine new genera. Most, if not all, of his papers were accompanied by original, carefully drawn plates illustrating the new species described. Most of them appeared in 'The Journal of the New York Botanical Garden' but others were published in botanical magazines of this and other countries. Part 2 of Volume 15 of the 'North American Flora,' a bulky quarto, bears his name as author. He became a worldwide authority on mosses and in the writings of other bryologists, many species and one genus bear his name.

Throughout all these years Robert maintained his interest in birds, both at home and wherever he wandered. A copy of McGregor's 'Philippine Birds,' found among his effects, was evidence that he had a live interest in Philippine birds during his two years there. During his early years in Minneapolis he made a small collection of birdskins which are now in the study trays of the Minnesota Museum of Natural History. Among them are specimens of the Blue-gray Gnatcatcher and Sanderling, original records of these species for Minnesota. When he went to Montana in 1879, he transferred his interest in Minnesota birds to those of that state. In 'The Auk' for 1879 to 1890 there are ten notes and articles by Williams, all but the first about Montana birds. The first is a note recording the taking of the Gnatcatcher and Sanderling at Minneapolis. Later, during the years that he was with the Botanical Garden, he kept an eye out for the birds in the Garden and in the 'Journal' there are from time to time brief articles recording the movements and nesting of the birds that came under his observation. A complete bibliography of the ornithological writings of Williams would probably include at least 25 or 30 titles.

In the April, 1903, and September, 1908, numbers of 'The Journal of the Botanical Garden' are interesting illustrated articles, narrative in style, giving accounts of his experiences collecting in Bolivia and Panamá. On the Bolivian expedition he had a severe illness which almost cost him his life, but he says nothing about it in the story.

Robert, from his school days, had a quiet, retiring nature forming few social contacts, and as he grew older he became something of a recluse. He never married. After his return to Minneapolis in 1940, he lived a retired life and took little interest in passing events. But he was loyal to his old friends and fond of talking about the early days. His speech was concise and direct and confined strictly to the subject under discussion. Any attempt at small talk seemed only to confuse him. Up to almost the last he took a three-mile daily walk around one of the park lakes near his home. His end came quietly, and a niece, Miss Ruth Williams, with whom he was living, said that "he just seemed tired of living and laid down and died," an appropriate ending for a man of Robert's temperament.—THOMAS S. ROBERTS, Minneapolis, Minn.

A CORRECTION.—REV. FRANCIS HOPKINSON CRAIGHILL, an Associate of the American Ornithologists' Union, elected in 1938, died in Rocky Mount, N. C., October 14, 1941. A notice of his death was prepared by Rev. John Gray for 'The Chat,' but through delay in the publication of that number, actually appeared in the September number, so that the obituary notice apparently was printed a month before the date of death. The notice in 'The Auk' for January, 1945, through an unfortunate error, appeared under the name Francis Hopkinson Smith, instead of Francis Hopkinson Craighill, but in the list of 'Deceased Members of the A. O. U.' in the April number, p. XIII, the name is given correctly.—T. S. PALMER.

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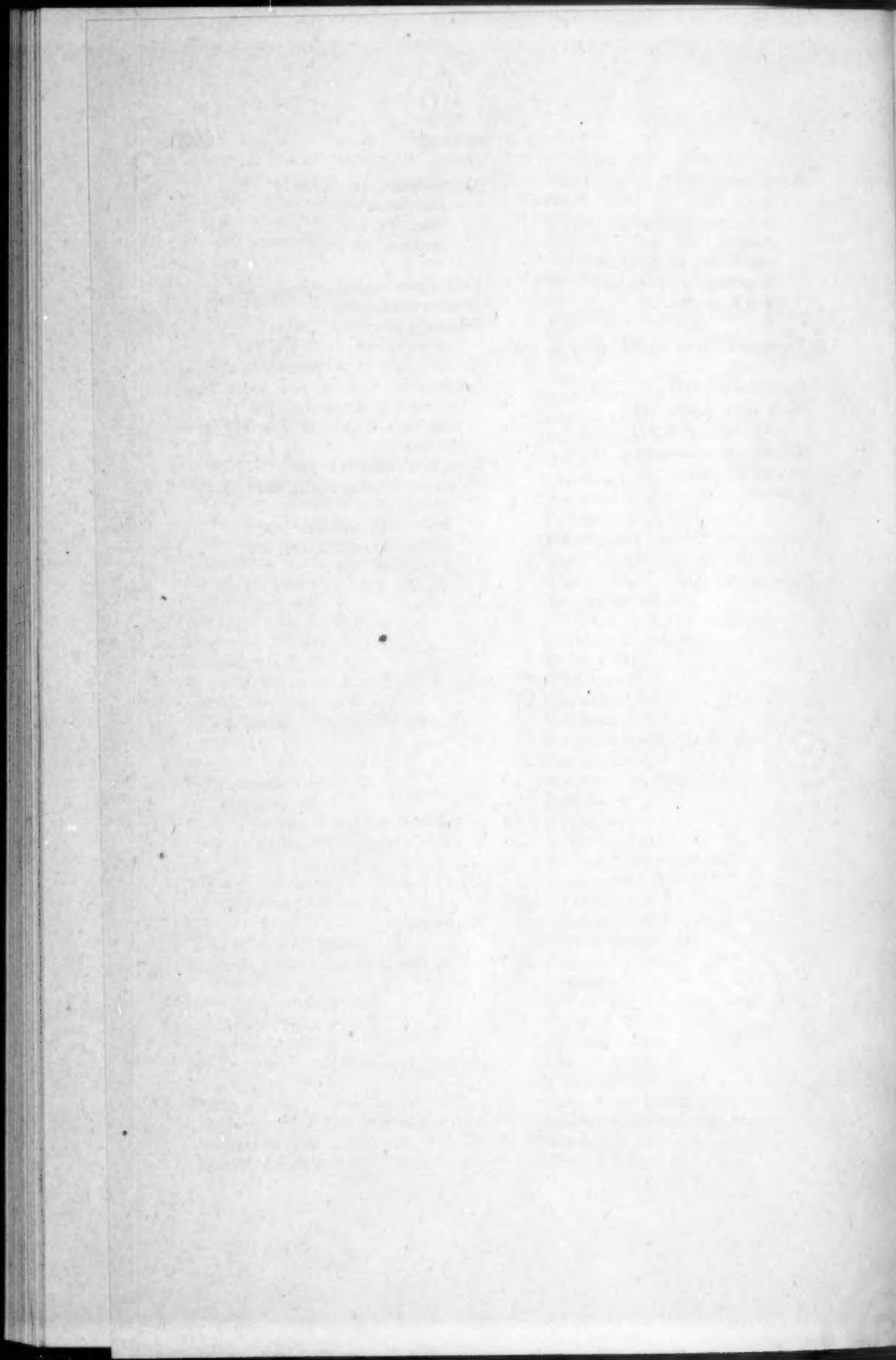
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